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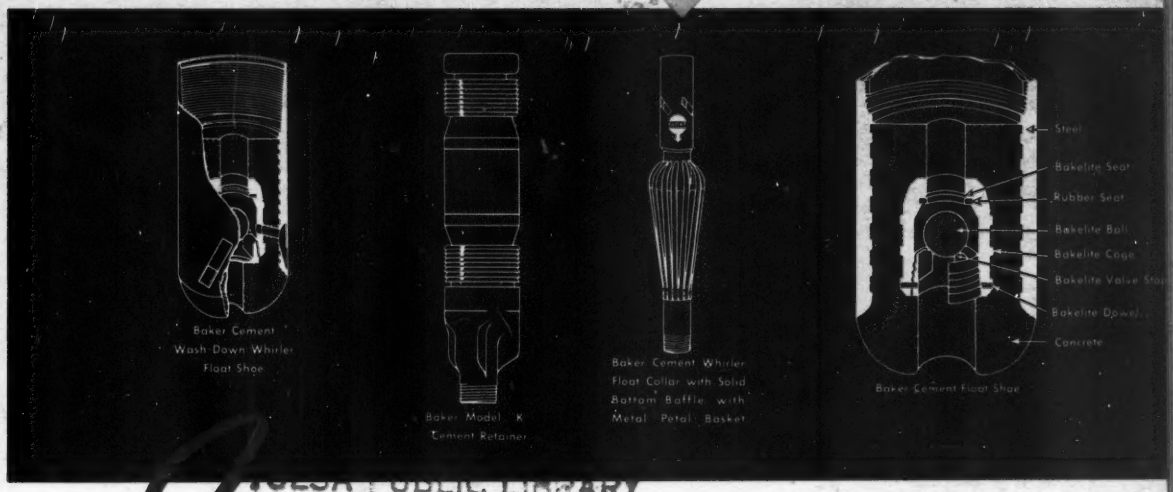

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Successful Oil Tools

ARE "DEVELOPED" NOT "DISCOVERED"

THE HISTORY of the machine age is a continuous story of discoveries . . . discoveries which opened the vistas to the remarkable period in which we now live. Discoveries, however, while tremendously important, are only the nucleus or starting point, for to be of commercial value most "discoveries" or inventions must be "developed."

It is both fortunate and unfortunate that oil tools are no exception to this rule. Fortunate because it is only through this tedious development period of trial and error that the refined product or tool can result . . . unfortunate perhaps (from the manufacturer's cost standpoint), because usually the development period continues more or less indefinitely as the result of constantly changing conditions under which the tool must operate: or requirements such as higher efficiencies which must be met.

Thus, products, such as make up the Baker Line of Oil Tools, which have been some thirty years in the development process, acquire a certain "face value" which operators have been quick to recognize and appreciate. Oil men the world over know that a tool or device bearing the word "Baker" reflects an invaluable background of accumulated experience . . . a background that results in the ability of each and every Baker tool to successfully perform the task for which is was designed.

Operating and supervising personnel, upon whose shoulders rests the bulk of responsibility for results, are doubly appreciative of this highly important background as it affords a measure of reassurance and peace of mind, the value of which is difficult to calculate in cold terms of dollars and cents.

The familiar Baker slogan "Practical and Dependable," is more than simply a play on words . . . it means just that, for to be successful, oil tools must necessarily be "practical and dependable" and practicability and dependability result from constant *development* . . . not *discovery* alone.

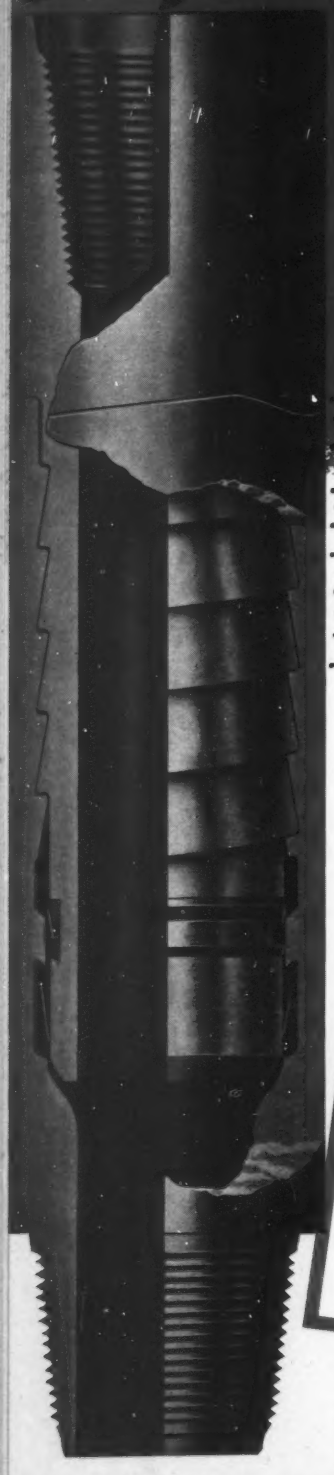
BAKER OIL TOOLS, INC.

P. O. BOX 127, VERNON STATION, LOS ANGELES, CALIFORNIA
P. O. BOX 3048, HOUSTON, TEXAS

Vol. 33
No. 2
Whole
No. 1553

To protect your well, use the

BOWEN SAFETY JOINT



THE BOWEN SAFETY JOINT combines in one compact unit every feature necessary for complete operating safety. Regardless of where you use it in your drilling string, you'll have positive assurance that the pipe can be disconnected at the Joint in any emergency.

Take a look at this tool. Notice that it has only two simple parts—a pin and a box section—with two lip type packers to eliminate leakage. Notice how **a full diameter opening is maintained at all points through the joint** so that all types of wire line tools can be run through it. In fact, this tool has the same inside and outside dimensions as tool joints of corresponding size, **yet it withstands greater torsional or tensile strains than the drill string!**

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And here's an important point to remember . . . the design of the Bowen Safety Joint is such that it will not loosen unless subjected to a **definite mechanical operation.** This means that bit or drill collar inertia forces . . . or rotating out of the hole . . . will not cause it to release. One to three unscrewing turns (depending on depth and mechanical conditions) followed by a downward bump of the string, are required to "break" the two halves of the joint. Otherwise they remain in tight engagement at all times without wearing or rotating against one another, thus assuring long life.

The Bowen Safety Joint can be used on any well. Its simple construction and operating features make it dependable on the toughest jobs, and it requires only periodic inspection. It's made in a wide range of sizes and threads for all makes of drill pipe.

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IN THIS ISSUE

Taming El Segundo's Wild 50 Million-ft. Gasser 2

Petroleum is Vanguard of South America's Advance (Conclusion) 7

A Practical Test Psychrometer for High Vacuum and High Temperature Work 17

Laugh This Off 30

San Joaquin Valley Development 32

Los Angeles Basin Development 36

Coastal District Development 40

Cole Committee in California—Association Resolution 41

Crude Oil Production 48

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January 26, 1940

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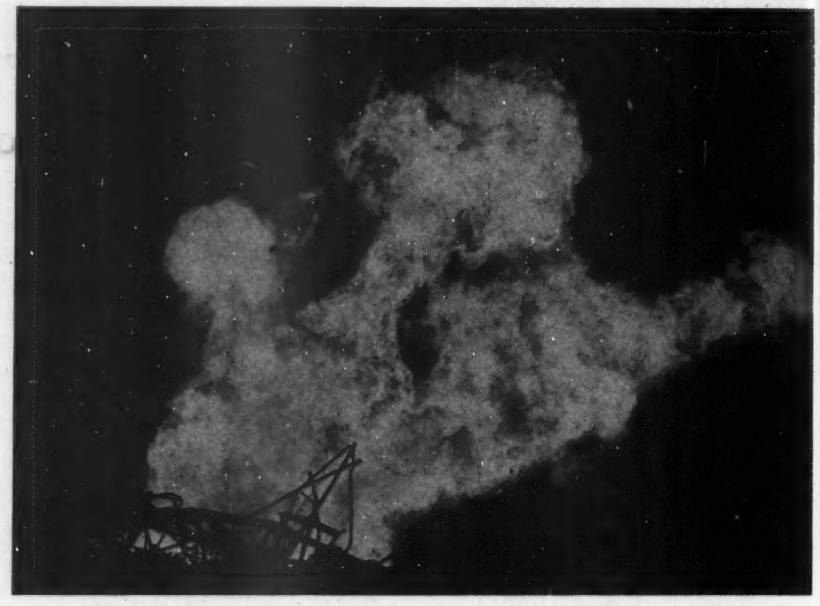
El Segundo's Wild 50 Million Foot Gasser

Tamed by Ingenious Harpoon

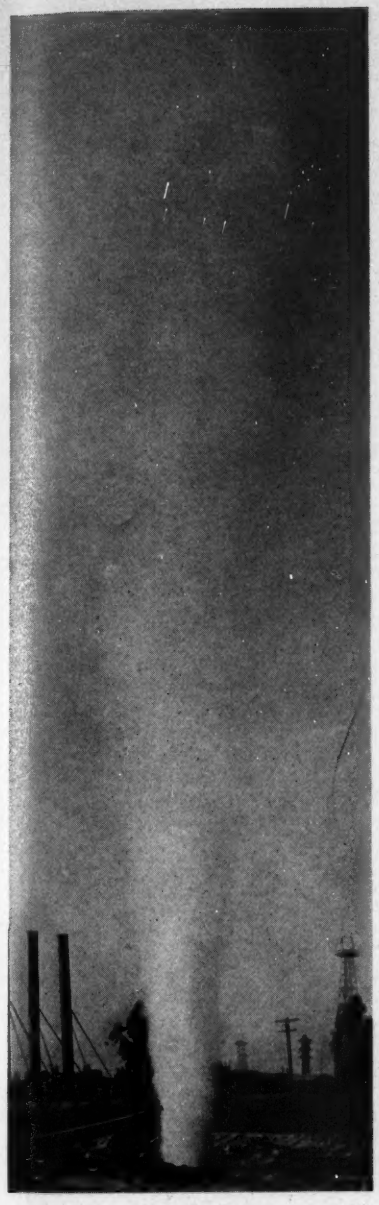
In El Segundo, where a high pressure gas sand above the oil producing formation causes the best attended wells to attempt suicide without the slightest warning, Ohio Oil Co.'s A. S. Gough No. 12 suddenly went on a rampage January 13, sand blasting away the well connections in a 50-million-foot blow and blazing into a gigantic torch which quickly reduced the steel derrick to a mass of tangled wreckage.

This well was the last drilled by Ohio in the Los Angeles Basin. It was completed as a 200-bbl. gas lift producer in June, 1938. While drilling, a formation test at 3800 ft. indicated the presence of commercial gas below the high pressure zones which had blown out other wells between 1000 and 2000 ft. When production dwindled to practically nothing, the 6⅝-in. water string was perforated from 3825 ft. to 3840 ft., a string of tubing run to approximately 7200 ft., and a packer set at 3844 ft. The gas obtained through the casing perforations was then brought to the surface around the outside of the tubing and introduced to the conglomerate and schist oil zone which is open from 7341 ft. to 7411 ft., through the 2⅞-in. tubing.

The shut-in pressure of the well was estimated at approximately 1450 pounds when the initial repressuring arrangement was completed. The oil sand, however, would not take the gas and it became necessary to install compressors to force the gas into the oil sand at approximately 3000 pounds pressure. All fittings on the well were 5000-pound test, so the men who had converted A. S. Gough No. 12 into as neat



Below: Preparing to harpoon the wild El Segundo gasser.



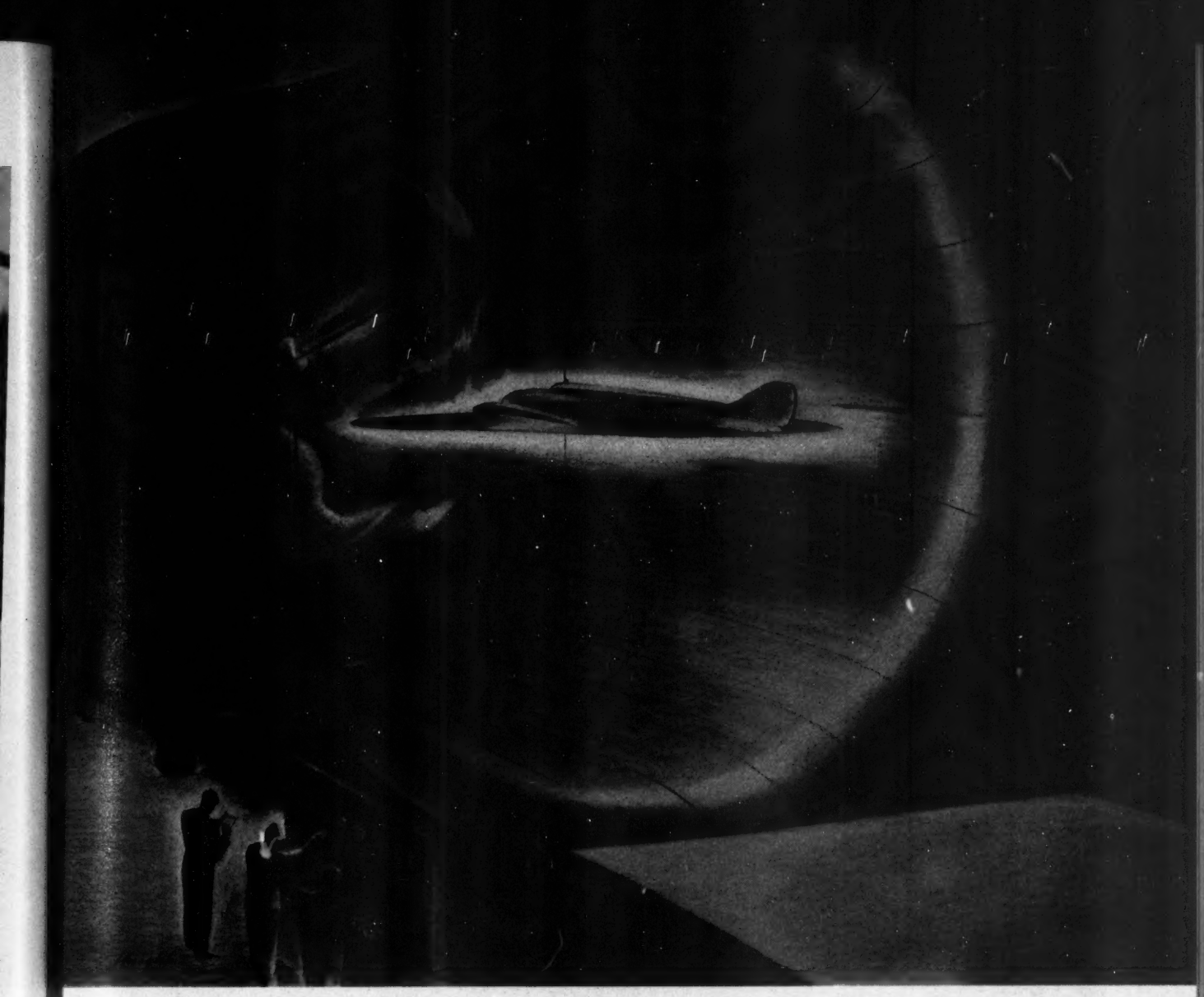
a self repressuring job as you will find in the literature were entitled to better than a brief success. Field Superintendent S. E. Furman was not caught flatfooted by the sudden disaster of this project, however, and in record time an Oil Field Construction Co. crew under the personal supervision of C. B. English had set up three 100 H.P. boilers and snuffed out the fire with live steam.

The destructive effect of a wild gasser blowing 50 million cubic feet of gas laden with sharp sand grains can be seen in one of the illustrations on these pages. Note the cut out condition of a heavy 7-in. stack lying near the cellar. Within a few hours after the fire was extinguished, the sand blasting through the 6⅝-in. had cut off everything down to the landing base heads in the cellar, dropped the tubing and cut out the packing in the casing head letting the well pressure against the 11¾-in. surface casing. The plug valve on the casing outlet cut out letting the well loose through this side outlet as well as blowing vertically through the 6⅝-in. casing.

Ohio lost no time in finding an experienced and well equipped wild well tamer. Roy N. Bean, sales engineer of Cameron Iron Works, Inc., who has seen action among the record high pressure wells of Louisiana, was called in to bring the well under control. Roy was promptly accorded the facilities of the Shaffer Tool Works for making up the equipment to harness the well. Working on an all too narrow margin of time against the terrific cutting action of the wild El Segundo gasser, the Cameron engineer's first move was an attempt to remove the

top flange of the casing head, and a manifold was made having a flange to match the head on the bottom of it, a 6x2 cross and a 6-in. 6000-pound Cameron pressure operated valve and a 7-in. stack above it for handling.

Now blowing between 50 and 60 million cubic feet a day, however,



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the wild gasser wrecked Roy Bean's plan by cutting out the flange and packing on the casing head, so that the flange up job had to be abandoned. A 6⅝ x 4¼-in. packer was installed on the bottom in place of the flange and an unsuccessful attempt was made to set this packer. The pressure was so great that it blew the rubbers and slips right off the packer.

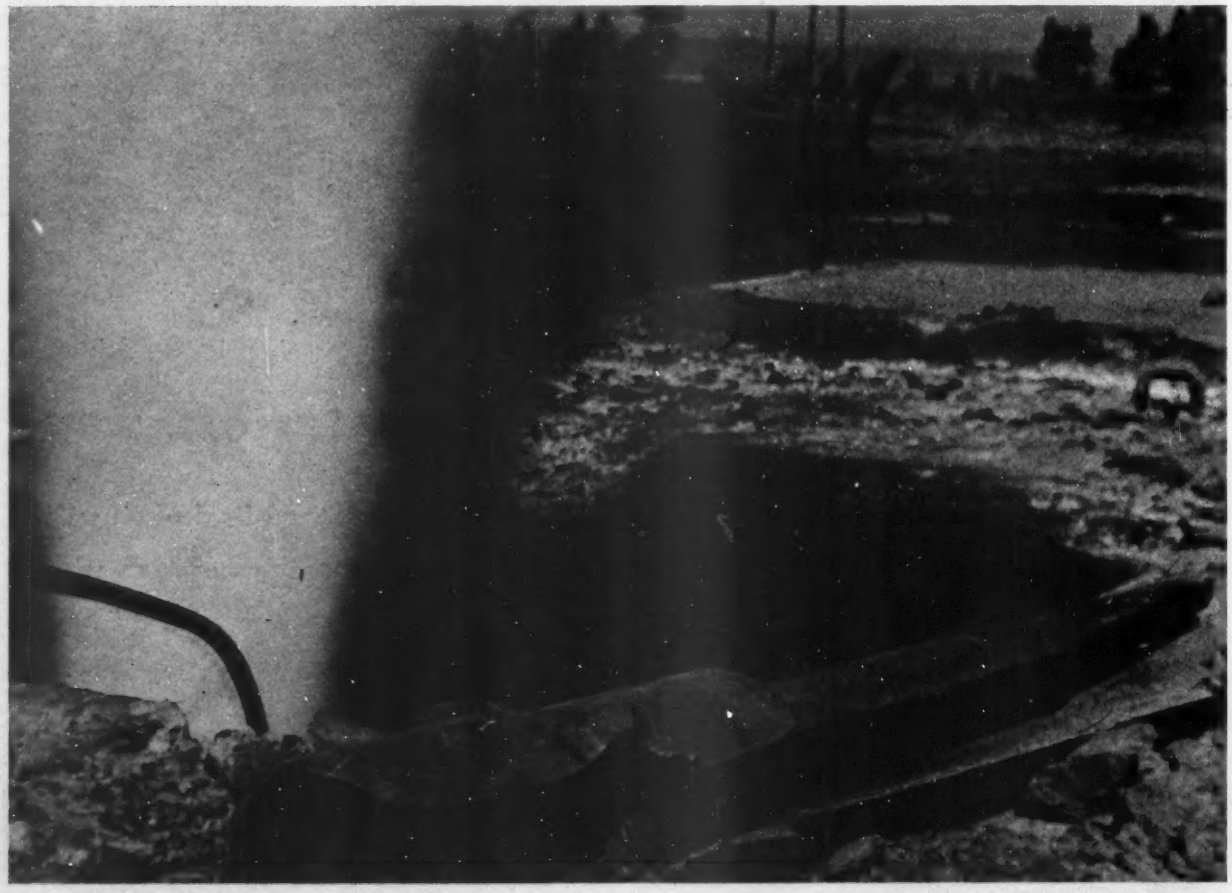
To prevent further cutting of the casing head and landing base, the wild well crew then put up a 10-in. stack over the cellar connections and left it on while securing a new packer. Two different types of packers were brought to the well and two attempts were made to set in the 6⅝-in. without success. Both the hook wall packer and the special cup assembly packer were cut to bits in the five minutes it took to stab inside the 6⅝-in. casing.

The job was getting tougher every minute and heroic action and unusual equipment were called for without a moment's delay. Roy Bean Sam Furman, and a score of fearless workers filled their ears with vaseline and cotton, donned football helmets or just tied down their hats Arctic style, and came to grips with the giant sand blaster which might at any moment turn into a raging furnace. Similarly difficult was the task of the reporter of these events in obtaining a first hand description of these activities from one of the principal participants. Eventually Roy Bean consented to permit a quotation from his official report, as follows:

"The well started making more sand and a quantity of water, which we appreciated as it eliminated to a large extent any chance of the well again catching fire due to the sand cutting and friction. Thursday, after another packer attempt, it was decided to quit trying to use stock packers, so Sam Furman, the superintendent for the Ohio Oil Co., and I designed a special packer with no slips on it. We made it up Paul Bunyan style in the Shaffer Tool Works shop at Santa Fe Springs. For the mandrel we used a joint of 4½-in. O.D. 16.60-pound Grade D drill pipe, for the collapsing sleeve, a joint of 5-9/16-in. O.D.22-20-lb. drill pipe. These two were threaded with a left-hand thread 5-thread Acme using a bronze thrust ring above the topmost thimble. For packing we used three packer rubbers furnished by the Securaloy people.

"The annular space between the outside of the 4½-in. and the inside of the 5-9/16-in. drill pipe was filled with grease. A stuffing box was used on the top of the 5-9/16-in. to seal to the 4½-in. mandrel. The 4½-in. drill pipe and packer assembly was approximately 25-ft. long. Near the top of the 5-9/16-in. a turning means was welded on. (As indicated on the drawing on page 44).

(Continued on Page 43)



Petroleum is Vanguard of South America's Advance in World Commerce

By Wallace A. Sawdon
Petroleum Engineer, Los Angeles

CONTINUED FROM
The First Issue, January, 1940

In the First Issue, February, will appear the first of Mr. Sawdon's series of technical articles on California practices.

Two small refineries, one of 7200 barrels capacity belonging to Lago and the other of 2000 barrels operated by Mene Grande, are located at the north end of the Lake Fields. A much larger refinery with a capacity of 25,000 to 30,000 barrels per day is operated by Caribbean Petroleum Company, one of the Shell group, at San Lorenzo which is on the lake several miles south of the Bachaquero field. Oil for this refinery, however, comes from the Mene Grande field which is approximately 10 miles east of the Lake.

Outside of the Lake Fields, the Mene Grande field, operated by Caribbean, is the largest producing field in the Maracaibo Basin. This is the oldest field in Venezuela but drilling has been very active during the past year although production has declined. The oil comes from two zones and the deeper wells average 5000 feet in depth. The structure, however, is a plunging nose with a very steep western dip.

The other producing fields east of the Lake in the Maracaibo Basin are El Mene, Media, Hombre Pintado and Las Palmas, all of which are operated by British Controlled Oilfields, Ltd. Oil from these fields is piped to the neck of the Lake opposite the city of Maracaibo where it is loaded on tankers for shipment.

West of the Lake at the north are the La Paz and La Concepcion fields. Both are operated by Caribbean Petroleum Company with the oil being piped to the Lake just south of Maracaibo.

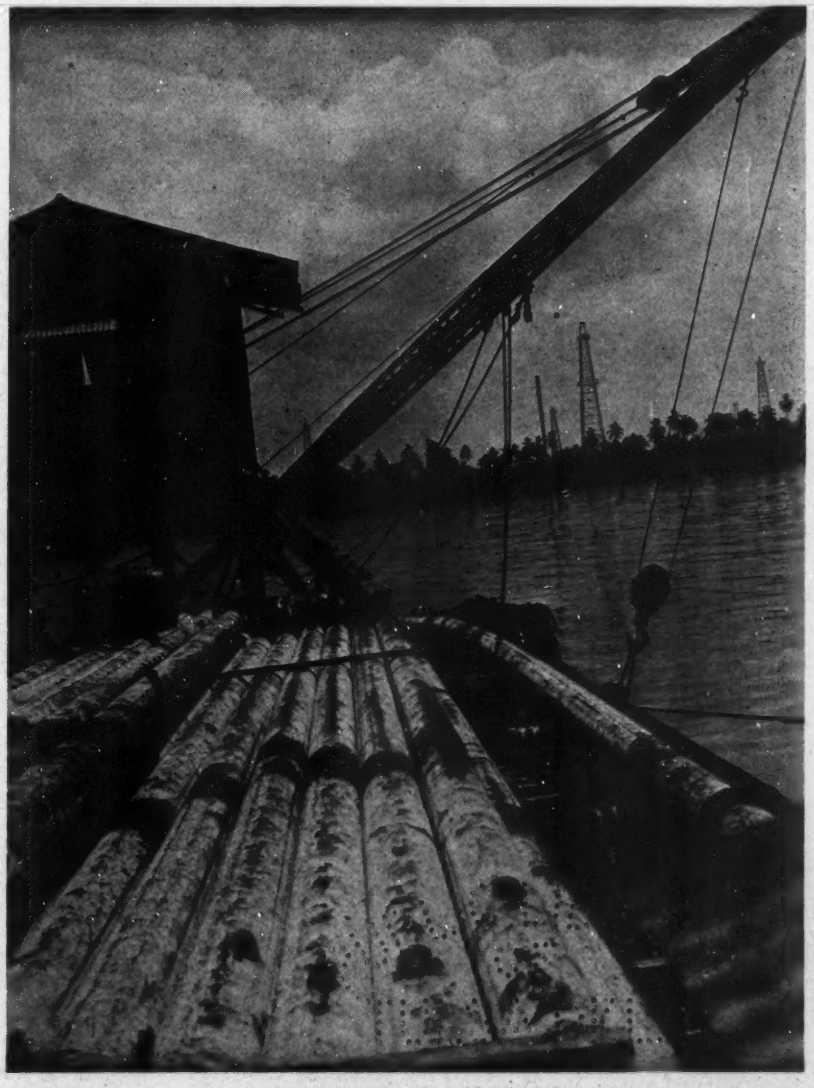
In the Colon District southwest of Lake Maracaibo but in the Maracaibo basin are the Los Manueles and Rio Terra fields. These are operated by the Colon Development Company, Ltd., another Shell subsidiary. A 90-mile pipe line carries the oil from these fields to a port near the southern tip of Lake Maracaibo.

While not in the Maracaibo Basin but still in Western Venezuela is the Cumarebo field. This field, operated by Standard Oil Company of Venezuela (Standard of New Jersey), produces the lightest oil found in the country with gravities reaching above 50 deg. A.P.I.

Eastern Venezuela

Considerable attention has been given to developments in Eastern Venezuela during the past few years. How great its production will eventually be cannot be foretold but fields recently connected to shipping points by pipe line, and oil picked up in varying amounts in numerous tests drilled throughout the entire area north of the Orinoco River and west of the Orinoco Delta have indicated that Eastern Venezuela may become an even more important factor than it is today.

While headquarters for Standard Oil Company of Venezuela have been established in Caracas, the company's operations are directed from Caripito which lies just off the San Juan River and near the Quiriquire field. Here are extensive shops and the location of a refinery which is the only refinery operating in Eastern Venezuela at the present time. This refinery has just been enlarged and will soon be able to handle



Laying a 10-in. line from a Lago flow station to shore. The line is first floated, then filled with water to make it sink to bottom and the water finally displaced with the oil.

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more than 20,000 barrels of crude per day.

The Quiriquire field operated by S. O. of V. has been the big producing area of Eastern Venezuela. Depths of wells here average approximately 3000 feet. The oil goes by pipe line to Caripito where some is taken to the refinery and the rest pumped to a port a few miles distant on the San Juan River. Both crude oil and refined products are there loaded on ships, much of the crude going to the refinery at Aruba via Guiria.

To the south and near the Orinoco Delta is the Temblador field, also operated by S. O. of V., which began shipment of oil in 1938. Well depths at the present time average approximately 4000 feet. This is a long narrow structure but producing wells in nearby areas indicate that there may be great oil possibilities over the entire territory north of the Orinoco and west of the Delta and extending westward beyond the Oficiña field. Oil from Temblador is piped to Boca de Uracoa on a branch of the Orinoco where it is loaded on tankers and carried north to the Gulf of Paria (lying between Trinidad and the mainland) and thence to Guiria for transshipment.

Padernales, lying just across from Trinidad, consists of some wells on the Island of Cotorra and some on the mainland across a channel of the Delta. A number of the wells are water locations and others are combined water and land operations. The depths average about 6000 feet. A loading port for shallow draft steamers is near the field and oil is there loaded on tankers which go to Guiria where transshipment is made.

Of particular interest during the past year has been the new Oficina field of Mene Grande Oil Company, a Gulf subsidiary. Just north of the field at San Tome the company has built a field terminal with complete industrial plants and warehouses. A 16-inch pipe line, 97 miles in length, has recently been finished to transport production from Oficina field to a deep water terminal west of Guanta on the Caribbean Sea. At this point a large refinery is to be built.

With completion of the pipe line providing facilities for shipment of oil from the Oficina field, development of the area will probably be rapid. Production has been picked up in test wells drilled to the south and east of Oficiña and to the north on both sides of the new pipe line. To what extent new producing areas will be brought in throughout the territory lying between Temblador and Oficina southward to the Orinoco cannot yet be foretold.

This absorption plant in the Ancon field was constructed totally in the field.

Aruba and Curacao

Just off the coast of Venezuela in the Caribbean Sea are the islands of Aruba and Curacao where are located the largest refineries of South America. On Aruba there are two refineries, the larger being that of Lago Oil and Transport Company (Standard of New Jersey subsidiary) which has an estimated capacity of 250,000 barrels per day. The other plant is operated by Arend Petroleum Maatschappij (Shell Subsidiary) and has a capacity of approximately 20,000 barrels per day.

The Lago refinery on Aruba takes mainly oil produced by the Standard companies in Venezuela and Colombia. In addition to the other refined products manufactured, a considerable amount of which is Diesel fuel, aviation fuels and aviation blends are now made at this plant.

On the island of Curacao the Shell interests have their big refinery. This plant has an estimated capacity of 175,000 barrels per day and is operated by Curacaosche Petroleum Industrie Maatschappij.

Trinidad

Trinidad is Britain's greatest oil producing colony and while development of the various fields and exploratory work throughout the island have been extremely active during the past few years, greater drilling activity is probably now in progress than at any time in the island's history. Trinidad is divided by a range of mountains into northern and southern parts. All present production comes from fields situated south of these mountains but two important tests are now being drilled in the northern area. Wildcat wells are, however, also being drilled in several areas along the southern coast with the hopes of enlarging the present productive territory by discovery of new fields and extension of older ones.

There are at present twelve producing areas in Trinidad but in some cases the names given are somewhat conflicting. Along the Gulf of Paria, which lies between the island and Venezuela, are the Brighton, Vassigney, Guapo and Point Fortin fields. The Brighton field is just south of the famous Pitch Lake. Included with Guapo and Point Fortin are the Parryland, Kern and Cruse areas. To the southeast of these fields is Fyzabad, the largest oil field on the island which also includes Forest Reserve. East of Fyzabad is the new Penal field and beyond it Barrackpore. To the south of Fyzabad are Los Bajos, Palo Seco and Coro. Near the southeast corner of the island is Guayaguayare and just south of the central mountain range is Tabaquite.

Production for Trinidad in 1938 was 17,700,000 barrels and it is estimated that during the current year it will reach 19.5 million barrels. Considerably more than half of the crude produced is refined in the six refineries now operating on the island; and both refined products and crude oil are exported. The largest refinery is that of Trinidad Leaseholds,

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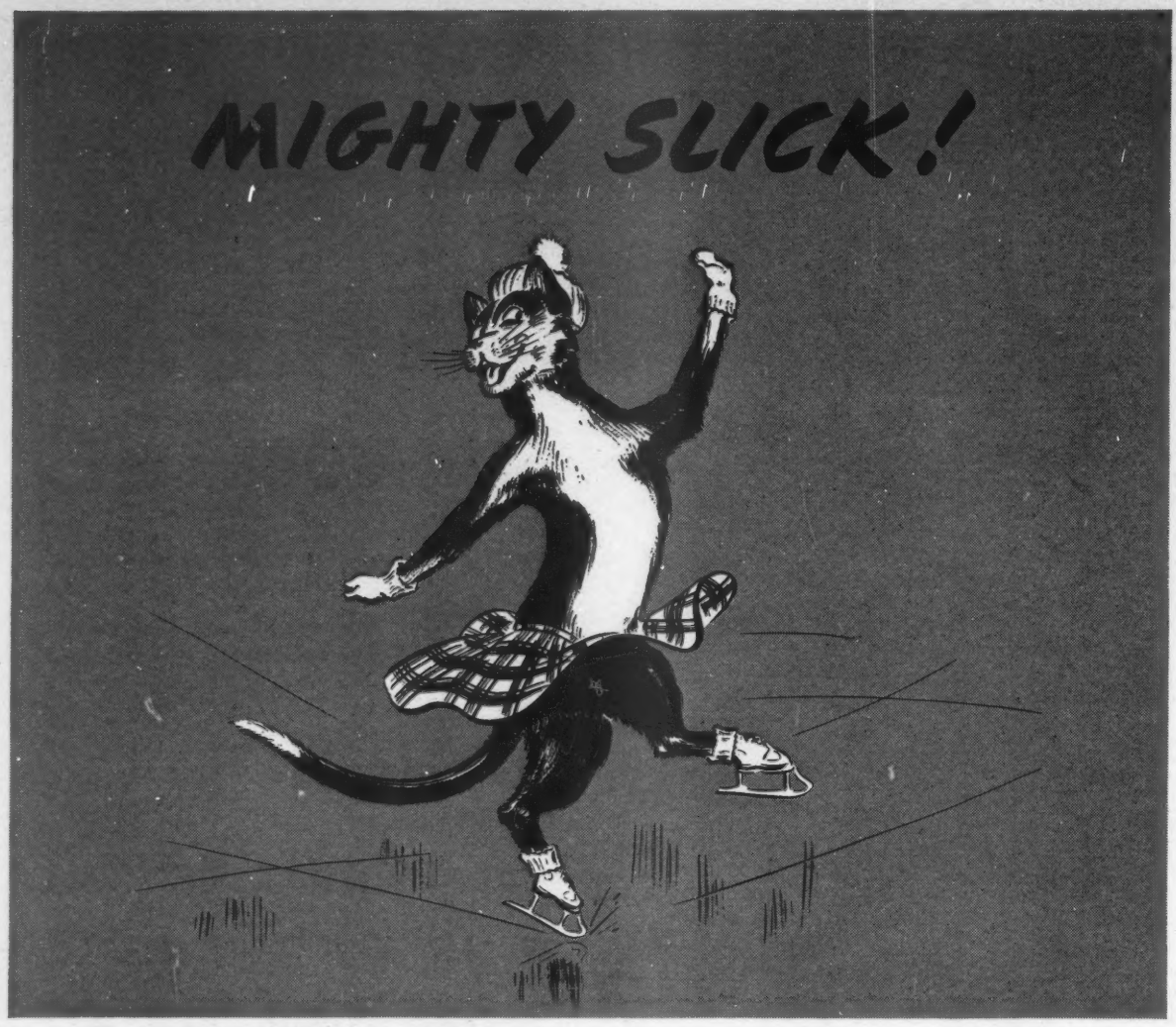
ELECTRICITY AT WORK IN THE OIL FIELDS



Dependable electrically operated pipe line pump in the Long Beach Harbor area. Gaso Pump; 60 horsepower U. S. motor.

Operators with electric motor pumping installations say they are the smoothest jobs out. The constant, even action of the electric motor reduces strains on the pumping equipment—consequently pump repair and replacement expense is lower. Electric motors are mighty slick to operate, too. Push button controlled, they start without trouble in any kind of weather, and keep running month after month and year after year at peak efficiency.

Find out for yourself why so many operators are switching to electric motors for pumping. An Edison power engineer can give you the facts and figures. He will call at your convenience. Telephone your Edison office.

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The first Motilone Indian ever brought to civilization. This boy was found in the jungle and is being taken care of by M. W. Seay, drilling superintendent for Colombian Petroleum Company at the Rio de Oro field in the Barco Concession, Colombia, who is holding him in his arms.

Ltd. at Pointe-a-Pierre with a capacity of 25,000 barrels per day. The second largest is the refinery of United British Oilfields of Trinidad, Ltd. (Shell subsidiary) that now has a capacity of over 5000 barrels but which will soon be expanded.

Most of the producing and refining operations are by British companies although the Shell and Standard both have production in Trinidad.

Colombia

With completion of the new pipe line from the Barco Concession to tidewater, Colombia now has two important producing areas. Up until the last few weeks all oil for export was producing by the Infantas and La Cira fields located adjacent to each other in the Magdalena Valley about two-thirds of the way from Barranquilla to Bogota. Oil from these fields has been piped to tidewater for the past 13 years. Total production from Colombia during 1938 was 21,660,000 barrels and the estimated production for 1939 is 23 millions barrels. With oil now being piped from Barco the production will probably be greatly increased during 1940.

The Infantas and La Cira fields are operated by Tropical Oil Company with headquarters at El Centro which is situated in the north end of the Infantas field. At El Centro the company has a complete industrial section including power plant, warehouses and shops of all kinds. This camp is connected by narrow gauge railway with Barranca Bermeja which lies on the Magdalena River about 17 miles to the west. Material and equipment for operations are brought over 300 miles up the river to Barranca Bermeja and from there transported on the railway to El Centro.

The Infantas is the older field with its deeper wells averaging less than 3000 feet in depth. The La Cira field is now being developed in an extended area. The deeper wells here average more than 4000 feet. In both fields production comes from three zones.

At Barranca Bermeja the Tropical operates a 7000-barrel refinery where refined products are manufactured for use throughout Colombia. These products include aviation gasoline and are shipped by boat on the river in both cans and in bulk. The railway shops are also located at Barranca Bermeja and those include a roundhouse with all facilities for maintaining and operating the very important line between here and El Centro.

The pipe line from El Centro to Mamonal, a port on the Caribbean Sea just south of the ancient city of Cartagena, is 335 miles in length. This line follows the Magdalena river which is a wide, shallow, meandering stream that floods the right-of-way during parts of the year. In addition to the loading station at Mamonal there are nine pump stations on the line. The line was originally 10-inch all the way but it has been looped with 10 and 12-inch pipe to such an extent that its original capacity has been more than doubled and it is now carrying more than 50,000 barrels of oil per day. This line is operated by the Andian National Corporation.

The Barco Concession, lying along the boundary between Colombia and Venezuela, now has two producing fields, Petrolea and Rio de Oro. Operation of the entire Concession is by the Colombian Petroleum Company. The Petrolea field is being rapidly developed since the new pipe line constructed from it to Coveñas on the Caribbean Sea now provides an outlet for its production. Wells here probably average somewhat over 3000 feet. Several wells have been drilled in the Rio de Oro field with production up to the present time from depths of less than 2000 feet. Whether a line will be run from this field to connect with the Petrolea-Coveñas line has not been disclosed.

Additional attention has been focused on the drilling of wells in the Barco and in the construction of the pipe line by the trouble caused by the Motilone Indians The Motilones have a nasty habit of taking pot shots with arrows at workmen which, either through poison or filth, infect any wounds made with them and prove very dangerous even when vital parts are not struck. A number of men, foreigners as well as Colombians, have been killed by the Indians in spite of precautions taken by the company in placing heavy wire netting around camp buildings and boats on the river and in stationing guards around drilling wells and along the pipe line during its construction. Only one of the Motilones has been brought into civilization—the boy shown in an accompanying photograph—and it is believed that any Motiline who has contacted a white man will be killed if he returns to the tribe after such contact.

In building the pipe line, the South American Gulf Oil Company (owned jointly by Texas Company and Socony-Vacuum) was faced with many difficulties in addition to the trouble caused by the Indians. The 12-inch line is 256 miles in length and had to be built across mountain ranges that reached an elevation of over 5000 feet at one place. It then drops down into the Magdalena Valley, crossing the river and two of its wide branches before continuing to the coast. Some of the equipment used for construction was flown in to various points by airplane. Three pump stations pump the oil to the top of the mountains from where it flows by gravity to the terminal at Coveñas.

Ecuador

An oil being produced in Ecuador comes from a peninsula on the Pacific Ocean just west of the city of Guayaquil. Moreover, most of this oil is being produced from the Ancon field which is operated by Anglo-Ecuadorian Oilfields, Ltd. Total production from Ecuador for the year 1938 was 2,250,000 barrels and the estimated production for 1939 is 2.3 million barrels.

Both rotary and cable tools are used in the Ancon field although most of the drilling is now being done with rotary. Two main zones are being produced, the upper with well depths averaging around 1200 feet and the lower with depths approximately 3800 feet. Oil from the upper zone is a low cold test oil and that from the lower a high cold test oil.

Of particular interest is the use of sea water for operations. Both the drilling and production operations in the Ancon field, which lies on the southern shore of

the peninsula and south of the town of Santa Elena, and the company's refining operations at a plant on the north shore of the peninsula use sea water. This requires specially constructed boilers. Drinking and other necessary fresh water is supplied by means of distillation.

The Anglo-Ecuadorian refinery is situated at La Libertad and has a capacity of 1000 barrels per day. Crude oil from the Ancon is transported 12 miles through a 6-inch pipe line to a tank farm at La Libertad where there is also a terminal for ships. Crude oil is loaded on tankers by a 10-inch sea line which extends two miles from shore.

A discovery made during the past year at a depth of 3800 feet in an area known as the Tigre Claim has increased interest in this territory. The new wells are just north of the eastern end of the Ancon field but not on an extension of that field. This claim is operated by the Ecuador Oilfields, Ltd. which also has some older production in the Cautivo field lying east of La Libertad and northwest of Santa Elena. A small refinery is also situated at Cautivo where the oil comes from hand-dug pits and shallow wells.

To the west of La Libertad there is an area known as the Carolina field which also produces from old pits and shallow wells. Another old producing area is the El Tambo field held by International Petroleum Company. Some recent wells have been put down in this area and production has been somewhat increased.

Peru

The first commercial petroleum production of South America came from Peru. Up until less than a year ago, however, all of the oil produced in the country came from the extreme northern coast. The new discovery east of the Andes has indicated the possibilities for greater production in Peru although no other areas on the east side have yet been tested. Production during 1938 was 15,838,000 barrels and estimated production for 1939 is 14 million barrels. This decline may be made up in 1940 by further extensions or discoveries of new production areas in the coastal fields or by provision of an outlet for the production from the Aguas Calientes field on the east side of the mountains.

The present main producing areas of Peru are the Negritos fields south of Talara an the Lobitos fields north of Talara. The Negritos area is operated by International Petroleum, Ltd. and drilling is done with both rotary and cable tools. Production headquarters are at Negritos which is connected to Talara by a railroad. At Talara are located the tank farm, refinery and port. Crude from the Negritos fields goes by pipe line to Talara where some is refined and the remainder loaded on tankers by sea line.

Wells in the Negritos fields range in depth up to nearly 5000 feet. Production comes from several sands and consists of both high cold test and low cold test oils. All gas is utilized and natural gasoline made in the field is piped to the refinery at Talara for use in blending.

Of particular interest is the narrow-gauge railway system laid out over the Negritos fields and connecting with Talara. The railway also runs to the water supply station on the Chira River about 30 miles south of Talara to individual wells to which tracks are laid when a well is to be drilled. This railway system, moreover, has been made available for automobile travel by putting asphalt tracks outside of each rail. The combined railway-highway system thus provides for all kinds of transportation over every part of the extensive producing district. While the railway is not a public carrier, the company runs passenger trains every week between Talara and the Chira river and allows Peruvians to use it without charge.

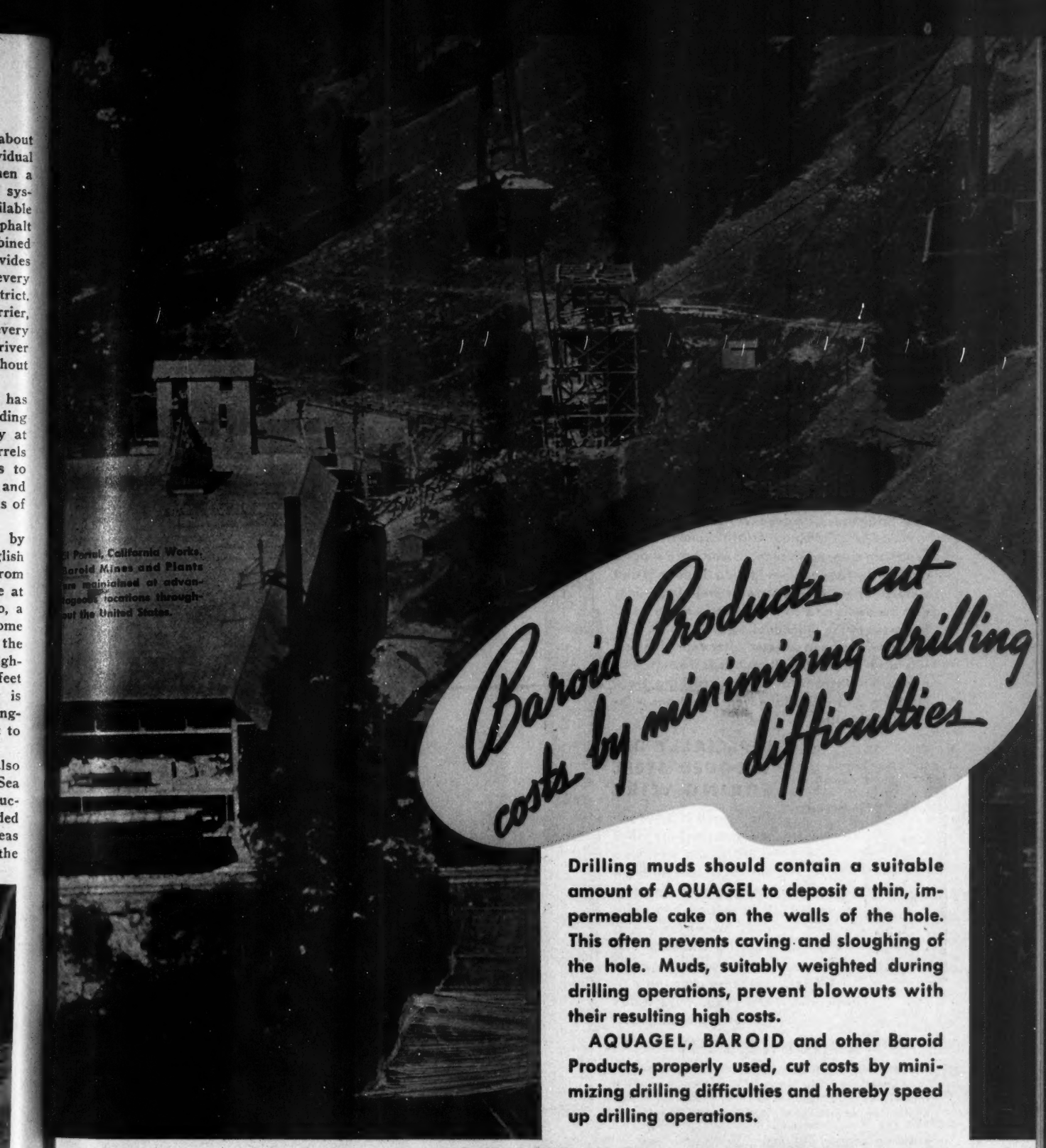
Talara is an excellent harbor and has two moles for the loading and unloading of ships. The Interntional refinery at Talara has a capacity of 16,000 barrels per day and ships refined products to various South American countries and Europe as well as supplying the needs of Peru.

The Lobitos fields are operated by Compania Petrolera Lobitos, an English company. Shipments of crude from these fields are from two points, one at Lobitos and another at Cabo Blanco, a point at the north end of the area. Some of the Lobitos fields are along the ocean shore while others are on a highland that rises nearly a thousand feet directly above the shore. Drilling is done with cable tools with wells ranging in depth from less than 1000 feet to about 4000 feet.

A narrow-gauge railway system also connects the wells in this district. Sea water is used for drilling and production operations. The district is divided into the Lobitos and Northern areas with headquarters for the former at the

VENEZUELA

Right: A cock fight near the Quiriquire field in Eastern Venezuela. Left: A flow station serving as field storage for a number of wells several miles off shore on Lake Maracaibo. The oil and gas are here separated, the oil being pumped to shore by electric motor driven pumps and the gas going into a compressor station also built on the lake.



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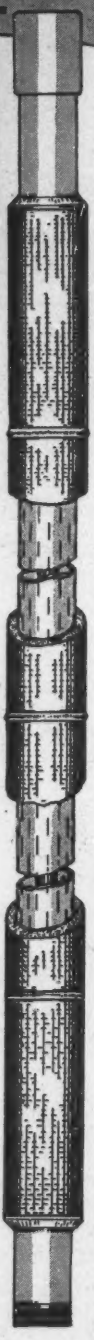

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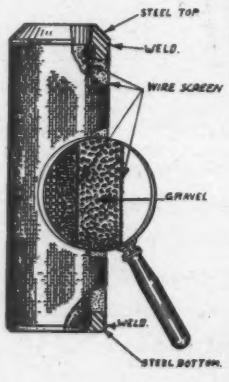
Gravel has been selected after extensive tests —is acid resistant, well rounded, fracture free and will withstand abrasion, crushing, field handling and subsurface well conditions without deterioration.



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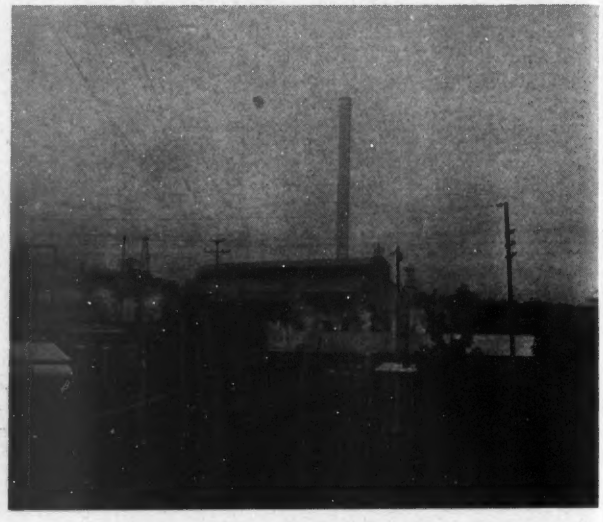
A booster station in the Infantas field, Tropical Oil Company's operations around El Centro in the Magdalena Valley, Colombia.



The power plant and the high pressure engine room of the gas plant at El Centro, Colombia.

This train is provided by International Petroleum Company for use of Peruvians and runs from Talara to the Chira River, 25 miles to the south.

Lobitos camp and that for the latter at El Alto camp. Distillation plants for drinking water and other necessary fresh water are located at both main camps.

Further to the north along the Pacific is a small field called Zorritos operated by Faustino G. Piaggio, an Italian concern. Here too is a small refinery which is capable of handling all the production from the field.

Of great interest is the Aguas Calientes field discovered early this year. This field is just off the Pachitea River about 20 miles from where it flows into the Ucayali River which in turn joins the Maranon River, the main stream of the upper Amazon system. Equipment for this operation is brought from Para, Brazil by steamer approximately 3000 miles up the Amazon system to the dock on the Pachitea. From here it is transported by truck six miles on a road built to the Aguas Calientes camp. The personnel for the operation and some small pieces of equipment usually enter by plane and automobile from Lima, Peru.

The Aguas Calientes field is operated by Compania de Petroleo Ganzo Azul, the "Blue Goose Oil Company", which is a Los Angeles, California organization. Drilling of the field is being done by the Drilling and Exploration Company, also a Los Angeles concern. Production at present is from a sand at a depth of little under 1200 feet. No oil is being shipped from the field as yet but wells are being put down to determine its productive limits. Eventually the crude, after being piped to a point on the Ucayali River approximately 28 miles north of the field, will probably be transported by means of lighters to Para or to a point on the Amazon which will accommodate sea going vessels.

Argentina

There are four main producing areas in Argentina. One of these, Comodoro Rivadavia, is on the Atlantic coast and is providing over 80 per cent of the total oil produced in the country. At the extreme north and extending into Bolivia is the area including the fields of the Salta and Jujuy Provinces. Just east of the Andes are the fields of Mandoza Province and Plaza Huincul in Neuquen Territory. Total production of Argentina in 1938 was a little over 17 million barrels and the estimated production for 1939 is 18.5 million barrels.

Over half of the country's production is by Yacimientos Petroliferos Fiscales (Argentine Government oil fields.) This organization also accounts for nearly half the refining capacity which includes facilities for refining imported oil as well as crude produced in Argentina. All of the large refineries are in and around Buenos Aires, La Plata, San Lorenzo, Bahia Blanco and Comodoro Rivadavia. Small plants of less than 1000 barrels per day are in each of the other three producing areas.

The various producing areas are divided into zones which are in themselves specific producing areas that contain one or more oil fields or pools. The Comorodo Rivadavia area, for example, contains several zones each of which covers more than one pool or proved productive area.

Comorodo Rivadavia is of particular interest in that it extends into the Atlantic ocean. During the past year or two, drilling of wells directionally into the reservoir below water was started. The methods being used are based on the ones developed in the tidewater fields of California.

Depths of wells at Comorodo Rivadavia average from 2000 to nearly 4000 feet. The deepest test yet drilled went to approximately 7600 feet. In addition to Y.P.F., operations are by Ferrocarrilera, Astra and Diadema Argentina.

At Plaza Huincul well depths average from 2000 to 3500 feet. No tests much below 5000 feet have been drilled in this area. One of the more recent wells has, however, picked up oil in a structure at greater depth than the horizon principally drilled. Operating companies in this field are the Y.P.F., Standard Oil Com-

(Continued on Page 47)

Wallace Sawdon, petroleum engineer and well known writer on engineering and technological activities in California and South American oil fields, will include articles on California applications and practices in the following subjects in the series he is writing for the California Oil World.

Deep Drilling Equipment:
- Derricks, rigs, boilers, etc.

Well Completions:
- Multiple zone completions.
- Drilling in with oil.
- Enlargement of hole through sand.
- Gun perforating.

Cementing:
- Cement and use of admixtures with cement.
- Casing jobs.
- Squeeze cementing.
- Special shut-off methods.

Pumping Methods:
- Rod pumping.
- Rodless pumping.
- Plunger lift operations.

Drilling Control:
- Blow-out prevention.
- High pressure hook-ups.
- Pressure drilling.

Production Control:
- Bottom hole pressures.
- Fluid level measurements.
- Back pressures.

Mud Control:
- Use of admixtures.
- Thixotropic qualities.
- Mud caking.
- Weight.
- Colloidal properties.

Gravel Packing:
- General considerations.
- Packing with liner in place.
- Use of pre-packed liners.

Directional Drilling and Controlled Vertical Drilling:
- Survey instrument and whipstocks.
- Straight hole instruments.
- Effect of rotating speed.

Electricity in Oil Field Operations:
- Drilling with electricity.
- Producing with electricity.

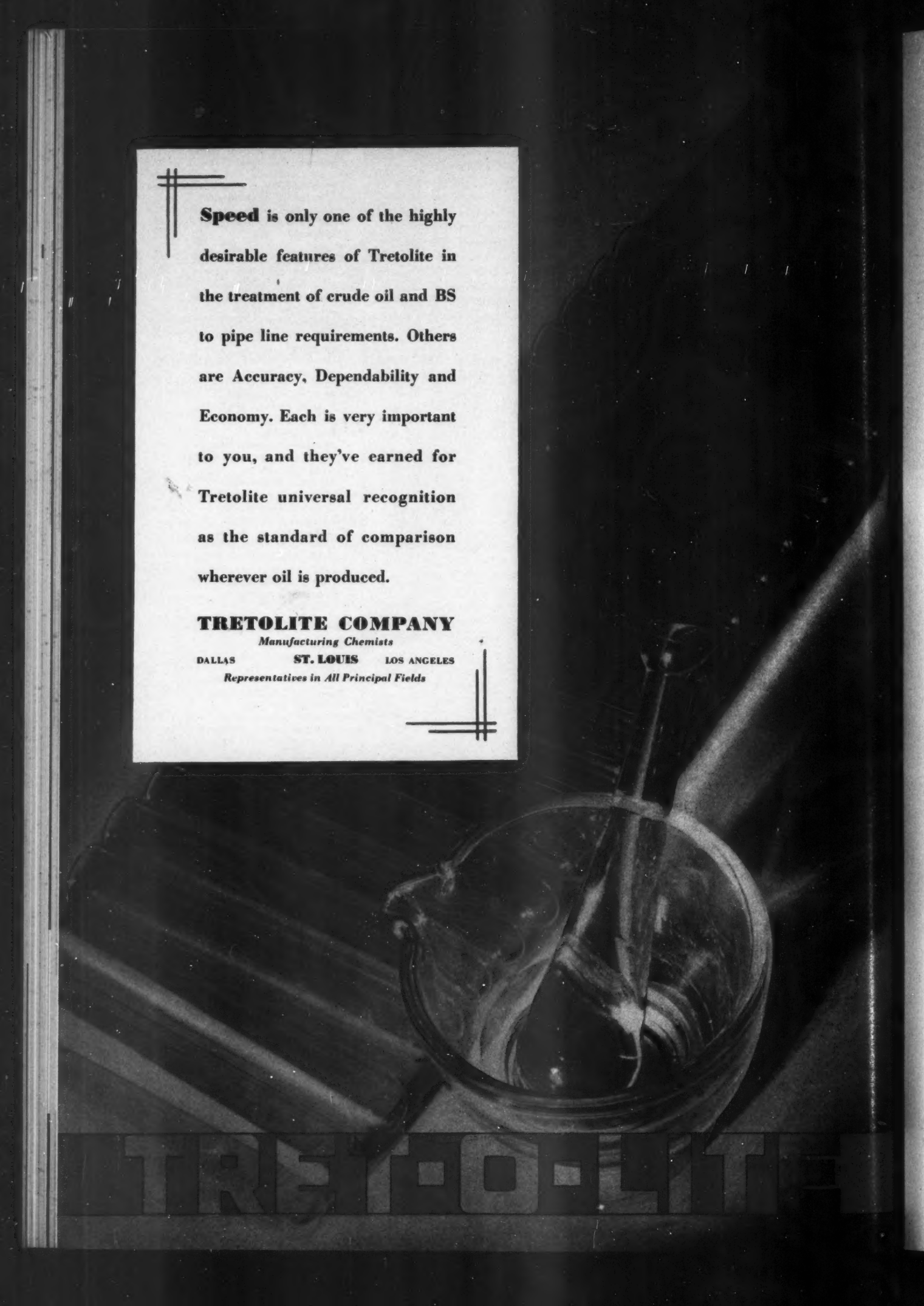
Drill Pipe and Casing:
- Efficiency of present pipe design.
- Casing and drill pipe equipment.
- Welded casing.

Electrical Logging:
- General application.
- Results secured in California.

Coring Methods:
- Conventional coring methods.
- Wire line coring.
- Core analysis.

TABLE II
PRODUCTION IN ARGENTINA
(From "Development of Petroleum Activities in the Argentine Republic during 1938" by Mario L. Villa in A. I. M. E. "Petroleum Development and Technology, 1939.)

Field	Total Oil Production in Barrels		Number of Wells		
			Completed		
	During 1938	To End of 1938	To End of 1938	During 1938	Producing At End of 1938
Comodoro Rivadavia (Chubut Territory)					
Zone A	4,973,931	99,475,979	2,387	57	1,708
Zone B	8,220,627	42,130,621	671	152	457
Zone C	916,050	16,179,244	710	51	344
Plaza Huincul (Neuquen Territory)					
Zone 1	56,446	1,601,226	84	...	42
Zone 2	497,948	3,178,645	150	12	105
Zone 3	425,009	9,232,223	213	1	143
Zone 4	7,384	43,243	10	2	2
Province of Salta					
Zone Tartagal	465,083	3,918,897	162	8	109
Zone San Pedro	1,229,209	8,727,998	45	2	31
Zone Aqua Blanca	83,242	867,619	10	2	6
Province of Jujuy					
Zone Yuto	82	3,397	5	...	2
Province of Mendoza					
Zone Cacheuta	107,307	263,915	38	7	26
Zone Tupungato	76,122	128,995	12	1	10
Zone Sosneado	17,713	254,795	14	...	12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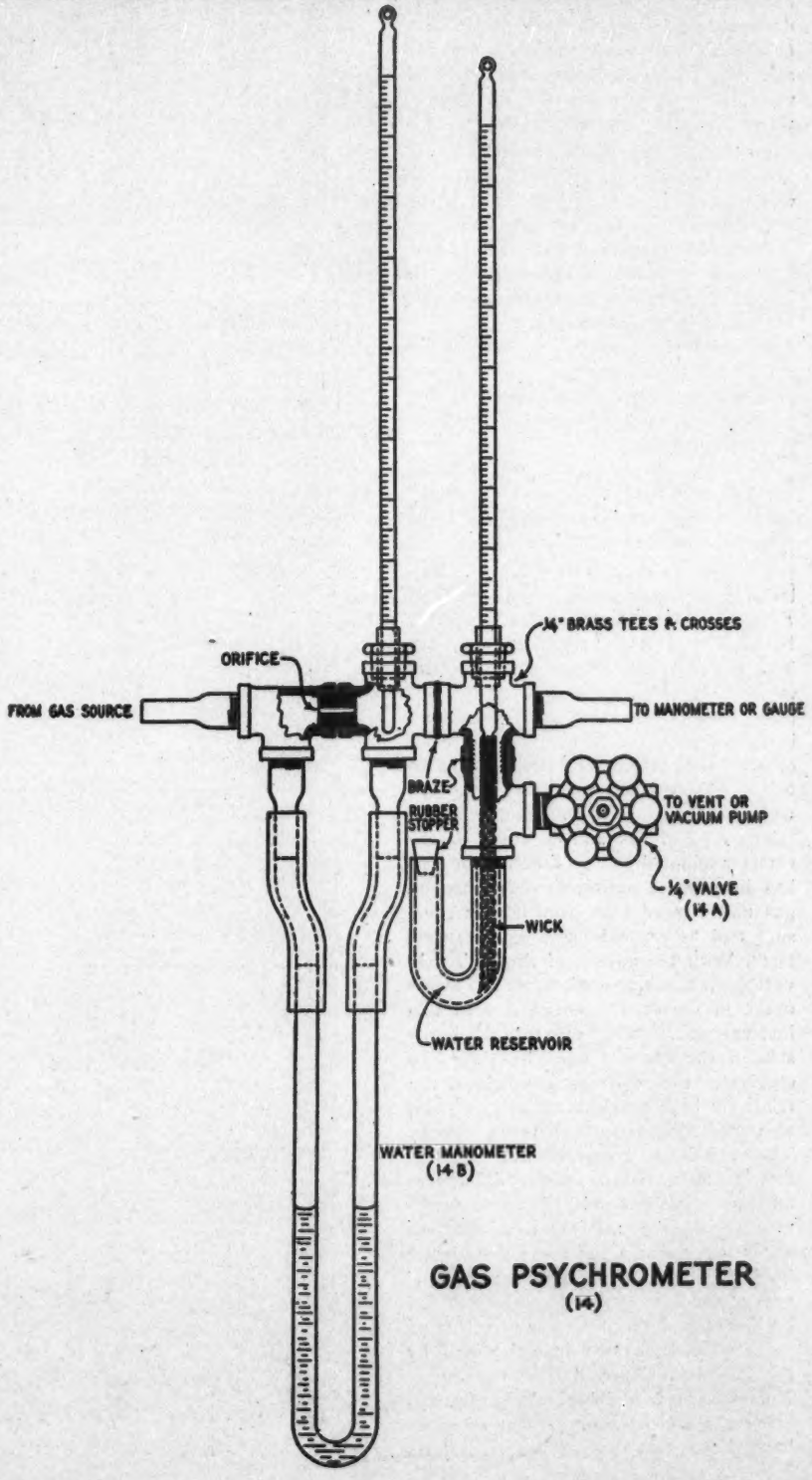
A Practical Test Psychrometer for High Vacuum and High Temperature Work

By R. S. Custer
General Petroleum Corp.
C.N.G.A. January Meeting

The standard procedure for the determination of the gasoline content of natural gas by the charcoal test specifies that the wet gas shall first be passed through the charcoal tube to remove the gasoline, then through a drier to remove the water vapor, and finally through a positive displacement gas meter where the volume of dry gas is then measured. In order to convert the dry gas volume to the original volume of wet gas that entered the charcoal tube, corrections are made for the gasoline removed by the charcoal and for the water vapor contained in the gas when it entered the charcoal tube. For the determination of the water vapor content C.N.G.A. Bulletin TS-351 specifies that a psychrometer as shown in Figure 11 of the Bulletin shall be used.

The essential features of this instrument are two thermometers; one, called a dry bulb, which records the temperature of the gas flowing past it, and the other, called a wet bulb, closely surrounded by a wetted adsorbent wick which dips into a well filled with distilled water. A flow of gas past the wet bulb will result in evaporation of water from the wick if the gas is at all unsaturated with respect to water vapor, and the heat removed by this evaporation causes a drop in the temperature. These two thermometer readings along with the pressure at the wet bulb as shown by the gauge are all the data necessary to calculate the percentage of water vapor in a gas. The psychrometer test is run in the field at the same time that the charcoal test is taken so that the water vapor content of the gas at the time of the test is known. The critical feature of this test is the velocity of gas past the wet bulb which must be at least 600 feet per minute as calculated at atmospheric pressure. If the psychrometer is constructed as specified in the Bulletin, a differential across the orifice of one inch of water at atmospheric pressure will give the required velocity. This velocity is a minimum, rather than a specific value and for vacuum tests is appropriately increased to account for the reduced pressure.

Now, if the volume of hydrocarbon gas passed during the charcoal test is divided by the percentage of hydrocarbons in the mixture of hydrocarbon gas and water vapor, a final volume will be obtained which will represent the volume of wet gas that entered the charcoal tube. In other words, dividing a water-free gas volume by a fraction



Right: Figure 11 of C.N.G.A., Bulletin TS-351, the psychrometer specified for water vapor content determination.

which is always less than unity will have the effect of increasing the gas volume to account for the volume of water vapor in the gas. This gas volume can now be used with the volume of liquid gasoline obtained in the charcoal distillation to compute the gasoline content of the wet gas.

The equation used by the C.N.G.A. in calculating the hydrocarbon fraction is derived by solving for the percentage, or fraction, of water vapor in the gas and then subtracting that fraction from unity, this form giving the fraction of water-free gas. Mathematically,

$$F=1-E/P=(1-E_w/P)+0.000053\,C(t_d-t_w)$$

where

F=the fraction of water-free gas.

E=vapor pressure of water at the dew point in inches of mercury; that is, E is the partial pressure of water vapor in the gas mixture.

P=absolute pressure of the gas in inches of mercury.

E_w=vapor pressure of water at the wet bulb temperature in inches of mercury.

C=molal heat capacity of the gas, Cal./gm. mol/°C

t_d=dry bulb temperature, °F

t_w=wet bulb temperature, °F

For convenience, the C.N.G.A. Bulletin gives the equation in the form of F=A+B, where A designates the factor $1-E_w/P$ and B is 0.000053 C (t_d-t_w). The Bulletin also presents a numerical table of A factors for a range of wet bulb temperatures and pressures found in field and one of B factors for a series of wet and dry bulb differences based on decreasing heat capacities of the gas with increasing temperature differences.

The type of wet and dry bulb psychrometer adopted by the C.N.G.A. in 1935 has been quite satisfactory for use on gas under more than atmospheric pressure and at normal operating temperatures. With the advent of the high field vacuums, numerous discrepancies were noted in the results obtained with this instrument. Testing on the discharge side of the vacuum units has failed to eliminate the discrepancies since the relatively high temperature at this point also contributes to erroneous results. The variations in comparative psychrometric tests show wide differences among themselves and little or no agreement with the maximum amount of water vapor that a gas may theoretically hold for any given temperature and pressure. The determinations indicate both undersaturated and supersaturated conditions. Extensive investigations by the C.N.G.A. Charcoal Test Committee No. 6 of other possible methods of measuring the water vapor content of gases have shown that the psychrometric tests

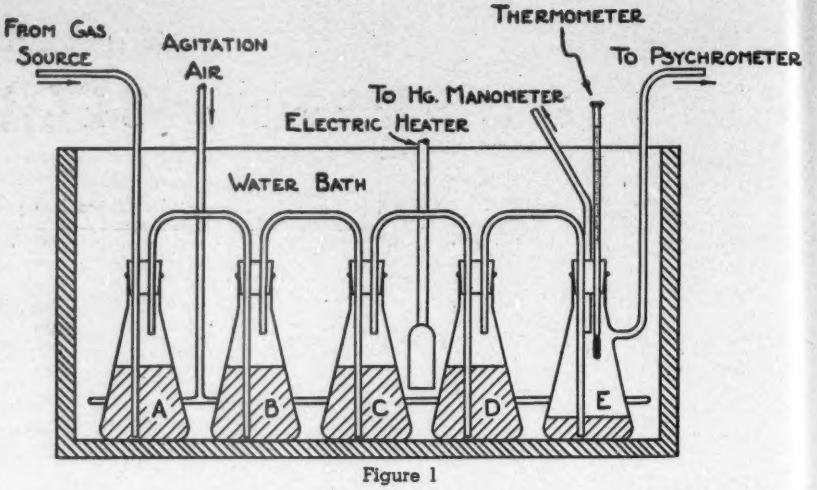


Figure 1

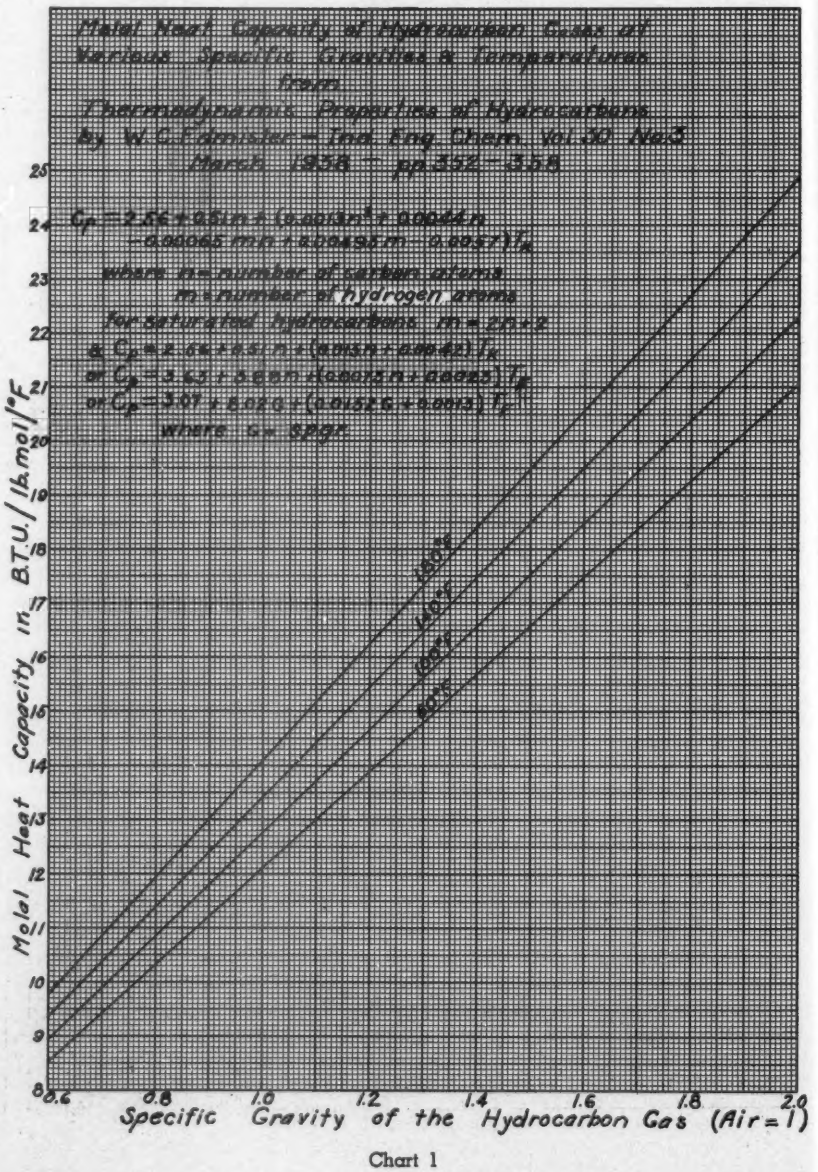


Chart 1

ENGINEERS ★ DESIGNERS
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Natural Gasoline Plants

Pressure Maintenance Plants

Gas Injection Plants

Gas Dehydration Plants

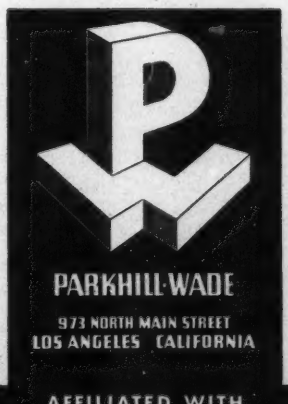
Stabilization Plants

Butane Production Plants

Butane Storage, Handling and Dispensing Equipment

Dust and Liquid Scrubbers

Cooling Towers



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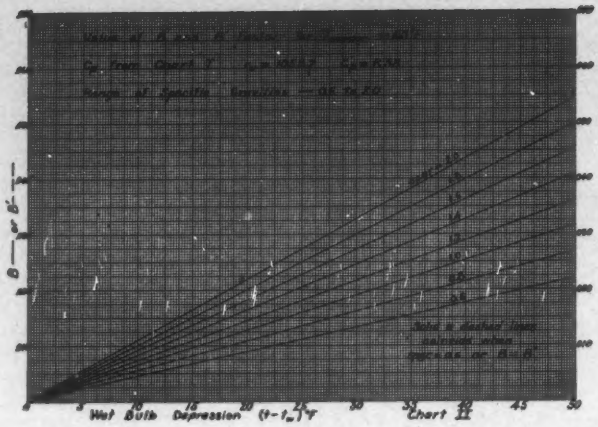
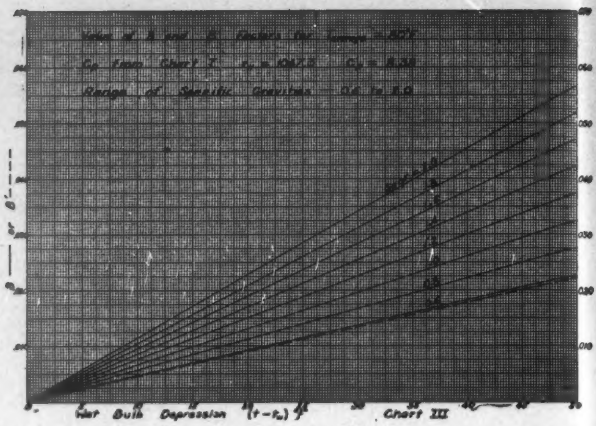




would not compare with either the results from a specially-designed dew point apparatus, or the direct drying method, or the condensation method. Also this committee has shown that these other procedures although more reliable for vacuum tests than the present psychrometer are still none too satisfactory from the standpoint both of accuracy and convenience.

If the errors in the results of psychrometer tests were always of the same percentage magnitude and in the same direction, the use of such results in gasoline content determinations would cause no serious inequities. However, inasmuch as the widest variations in results occur in gases under high vacuums and high temperatures where the water vapor content of the gas may be as high as 40% or 50%, large inaccuracies in the determination of the actual water vapor content lead to proportionately large inaccuracies in gasoline content determinations for such gases.

The object of the following work was: first, to study the theory of wet and dry bulb thermometry to determine the accuracy of the present C.N.G.A. equation for the water vapor correction factor and to derive a more accurate expression for this factor; second, to investigate the present C.N.G.A.-approved psychrometer to determine whether possible faults in its construction and use might account for the wide variations observed in the results, and third, to construct a new psychrometer that would give satisfactory results.

Discussion of the Theory and Fundamentals of Humidity and Wet- and Dry-Bulb Thermometry.

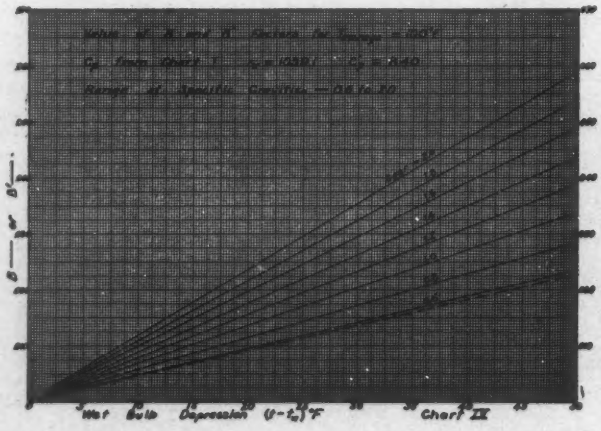
Principle of the Psychrometer.

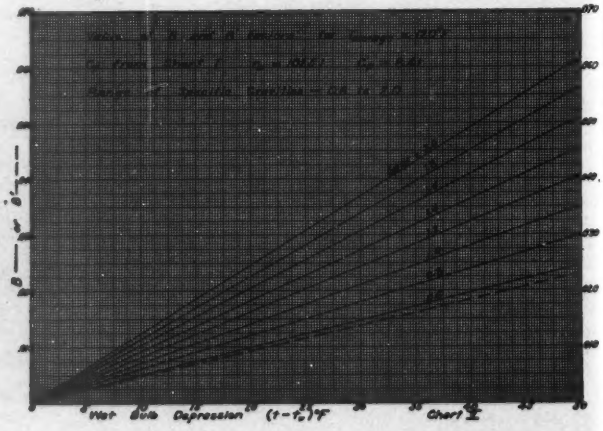
If a drop of water is placed in a gas unsaturated with respect to water vapor, evaporation of the water will take place at a rate which will depend on four separate factors: the area of the drop, the coefficient of diffusion through the gas film on the surface of the drop, the difference between the partial pressure of the water vapor in the gas and the vapor pressure of water at the drop temperature, and the conditions of the flow of the gas around the drop. This evaporation will result in a cooling effect on the water and a consequent lowering of its temperature below that of the surrounding gas. There will then be a flow of heat from the gas to the water drop, the rate of flow depending on the temperature difference between the drop and the surrounding gas and the coefficient of heat transfer through the gas film on the surface of the drop. At a condition of dynamic equilibrium, the instantaneous rate of heat transfer will be the same both for heat flowing to the drop and from the drop. This equlibrium will give a definite water drop temperature for any one gas temperature, pressure, and humidity.

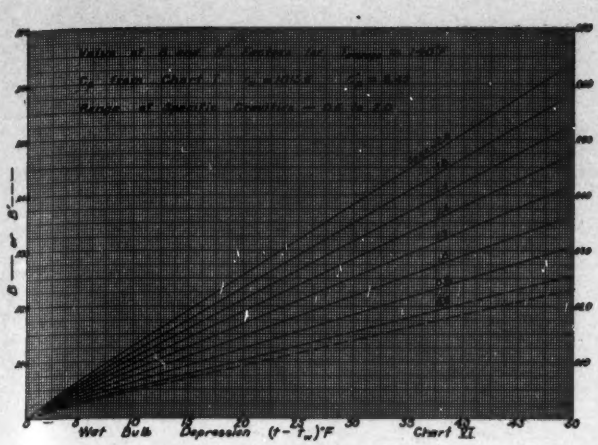
This principle can be applied to the measurement of humidity by determining the gas temperature and pressure and the temperature of the drop of water. The temperature of the drop of water is obtained by covering the bulb of a thermometer with a wetted cloth or wick and reading the temperature as the gas flows past this so-called wet-bulb thermometer. Using this phenomenon, an equation can be developed for computing the water vapor content of a hydrocarbon gas from the wet- and dry-bulb temperatures and the absolute pressure reading.

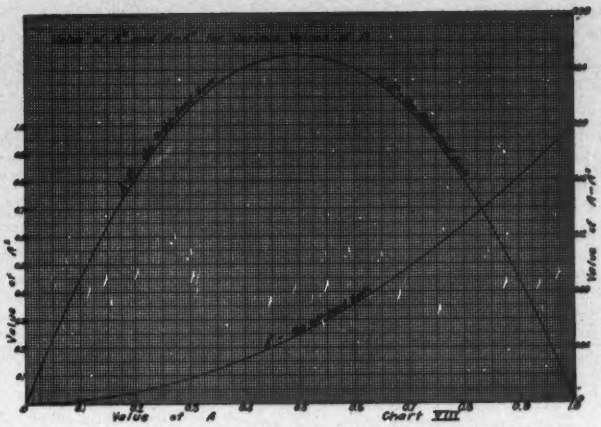
The C.N.G.A.-Adopted Equation for Calculating Percentage Humidity and Its Basis

While there are numerous charts and equations available for determining the humidity of air, they are not satisfactory for use with hydrocarbons because the results are given in pounds of water vapor per pound of bone dry air at normal barometric pressure. Walker, Lewis, McAdams, and Gilliland show the development of an equation for air which









gives the humidity in terms of the diffusion and heat transfer coefficients of the gas film around the wet bulb.[1] There are little data on these constants in the literature with the exception of those for air which show that the values of the diffusion and heat transfer coefficients are such that the final equation for air can be given in terms of properties of air which are more readily evaluated. However, the varying specific gravity of natural gas necessitates an equation giving humidity in terms of the percentage by volume of the water vapor in a gas.

The possibility that the discrepancies in humidity measurements by the psychrometer might be accounted for in the assumptions used in the development of the C.N.G.A.-adopted equation led to an investigation of its source. It was found that it had been taken from an article by W. W. Frymoyer published in the **Oil and Gas Journal** for Sept. 1, 1932, which merely mentioned it as an approximate equation derived by E. Buckingham. No reference could be found to the original article by Buckingham.

The form of the C.N.G.A. equation, which is the same as the one given by Frymoyer, has already been discussed.

Bulletin No. TS 351 presents a table of A factors for absolute pressures ranging from 10 to 32 inches of mercury and wet-bulb temperatures from 40° and 105° F. It also gives a table of B factors for temperature differences from 4° to 49° F. based on molal heat capacities at various gravities taken from the International Critical Tables and the Bureau of Standards Miscellaneous Publication No. 97: Thermal Properties of Petroleum Products. The B factors were formulated on the assumption that greater temperature differences occur with gases under high pressures and hence lower gravities and lower heat capacities. Thus, the B factors as given are for gases of progressively decreasing gravities.

An effort to derive this equation yielded the following which shows the assumptions needed and the approximations used in the development of the C.N.G.A.-adopted equation:

Assume a steady-state flow condition of gas past the dry and wet bulbs with the gas leaving the wet bulb at the temperature, t_w, and saturated with water vapor at that temperature. As a basis of calculation take one mol of hydrocarbon gas with its accompanying water vapor, then let

t = dry-bulb temperature in °F.

t_w = wet-bulb temperature in °F.

r_w = heat of vaporization of water at t_w in Btu/lb

C_p = molal heat capacity of the hydrocarbon gas in Btu/°F/lb. mol for $T_{average} = \frac{t+t_w}{2}$

C'_p = molal heat capacity of water vapor in Btu/lb. mol/°F for $T_{average} = \frac{t+t_w}{2}$

M_w = molecular weight of water

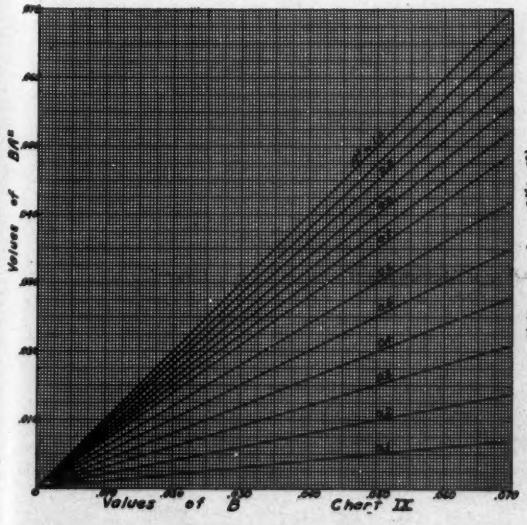
p = partial pressure of the water vapor in the incoming hydrocarbon gas in pounds per square inch

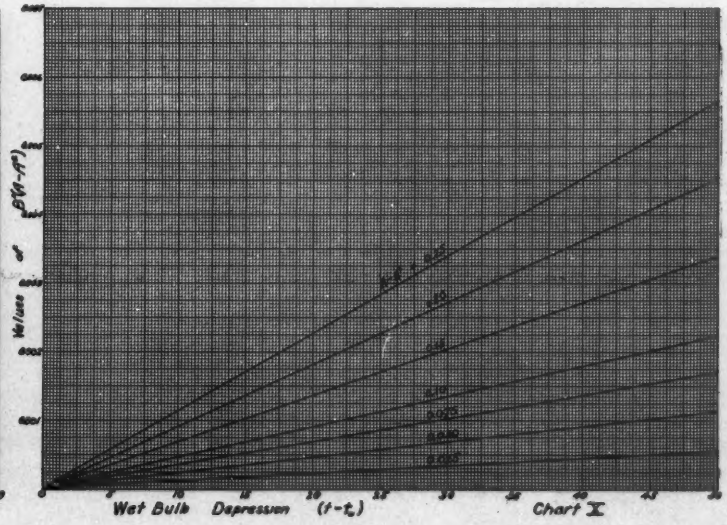
p_w = vapor pressure of water at t_w in pounds per square inch

ΣP = total pressure of the gas mixture in pounds per square inch

At a section just ahead of the wet bulb there are: [1 mol of hydrocarbon gas at $(\Sigma P - p)$ and t] + [m_1 pounds of water vapor at p and t accompanying each mol of hydrocarbon gas] + [m_2 pounds of liquid water to be vaporized at t_w for each mol of hydrocarbon gas] and at a section just after the wet bulb there are [1 mol of hydrocarbon gas at $(\Sigma P - p_w)$ and t_w] + [$m_1 + m_2$ pounds of water vapor at p_w and t_w for each mol of hydrocarbon gas]. Then for the above steady-state flow of gas the equation is

$$H_1 + x_1 + \frac{u_1^2}{g} + Q + W = H_2 + x_2 + \frac{u_2^2}{2g} + F \quad (4)$$





where

H_1 and H_2 are the enthalpies or heat contents of the system at Sections 1 and 2 respectively

x_1 and x_2 are the potential energies of the system at the two respective sections

u_1 and u_2 are the velocities of the system at the two respective sections

g is the acceleration of gravity in feet per second per second

Q is the heat added to the system between Sections 1 and 2.

W is the work done on the system between Sections 1 and 2.

F is the energy lost by friction in the system in going from Section 1 to 2.

Assume for the psychrometer that:

1. The change in potential energy between the two sections is negligible.
2. The change in velocity between the two sections is negligible.
3. No heat is lost to or gained from the outside, and no work is done in going between the two sections.
4. There is no frictional effects for that short distance of flow and hence P is the same at both sections.
5. Both the hydrocarbon gas and the water vapor are perfect gases for these temperatures.

Then the steady flow equation becomes $H_1 - H_2 = O$ and evaluating the change in enthalpy for the above process gives H for (Hydrocarbon gas) + (Water vapor) + (Liquid water) = O or

$$\frac{(C_p(t-t_w))+(m_1C'_p(t-t_w))+(m_3(-r_w))}{M_w}=0 \quad \ldots\ldots(5)$$

But by the perfect gas law $m_1=\frac{M_{wp}V_1}{Rt}$, where R is perfect gas law constant, and V_1 is the same volume as that occupied by the hydrocarbon gas which is $V_1=\frac{Rt}{\Sigma P-p}$; therefore $m_1=\frac{M_{wp}}{\Sigma P-p}$ $\ldots\ldots(6)$

$m_2=(m_1+m_3)=\frac{M_{wpw}V_2}{Rt_w}$, and V_2 is the same volume as that occupied by the hydrocarbon gas which is $V_2=\frac{Rt_w}{\Sigma P-p_w}$; therefore $m_2=\frac{M_{wpw}}{\Sigma P-p_w}$ and since $m_2=m_3-m_1$ $\ldots\ldots(7)$

then $m_3=\frac{M_{wpw}}{\Sigma P-p_w}-\frac{M_{wp}}{\Sigma P-p}$ $\ldots\ldots(8)$

Substituting these values in the above flow equation (5) gives:

$$C_p(t-t_w)+\frac{p}{\Sigma P-p}C'_p(t-t_w)-\frac{M_{wpwrw}}{\Sigma P-p_w}+\frac{M_{wprw}}{P-p}=0 \quad \ldots\ldots(9)$$

Rearranging:

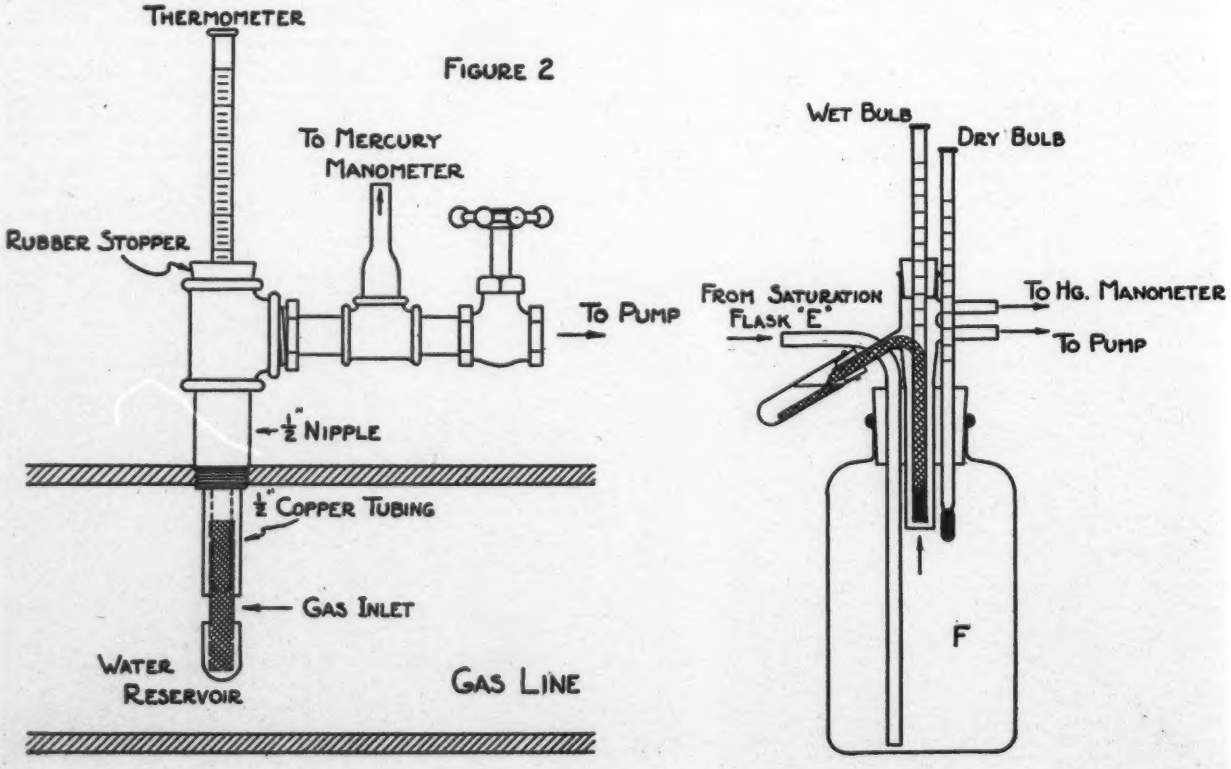
$$\Sigma PC_p(t-t_w)-pC_p(t-t_w)+pC'_p(t-t_w)-\frac{\Sigma P\ M_{wpwrw}}{\Sigma P-p_w}+\frac{pM_{wpwrw}}{\Sigma P-P_w}+M_{wprw}=0 \quad \ldots\ldots(10)$$

$$\Sigma PC_p(t-t_w)-p(C_p-C'_p)(t-t_w)\frac{\Sigma PM_{wpwrw}}{\Sigma P-P_w}+\frac{\Sigma PM_{wprw}}{\Sigma P-p_w}=0 \quad \ldots\ldots(11)$$

$$\left[\frac{\Sigma PM_{wrw}}{\Sigma P-p_w}-(C_p-C'_p)(t-t_w)\right]p=\left[\frac{M_{wpwrw}}{\Sigma P-p_w}-C_p(t-t_w)\right]\Sigma P \quad \ldots\ldots(12)$$

Now the CNGA water vapor correction factor is $F=\left(1-\frac{P}{\Sigma P}\right)$, hence:

FIGURE 2



$$F=\left(1-\frac{p}{\Sigma P}\right)=1-\left\{\frac{\dfrac{M_w p_{wrw}}{\Sigma P-p_w}-C_p(t-t_w)}{\dfrac{\Sigma P M_{wrw}}{\Sigma P-p_w}-(C_p-C'_p)(t-t_w)}\right\} \quad \ldots\ldots(13)$$

$$F=1-\left[\frac{M_{wrw}p_w-C_p(t-t_w)(\Sigma P-p_w}{M_{wrw}\Sigma P-(C_p-C'_p)(t-t_w)(\Sigma P-p_w)}\right] \quad \ldots\ldots(14)$$

$$F=1-\left\{\frac{M_{wrw}}{M_{wrw}-(C_p-C'_p)(t-t_w)\dfrac{(\Sigma P-p_w)}{\Sigma P}}\right\}\frac{p_w}{\Sigma P}$$

$$+\left\{\frac{\dfrac{\Sigma P-p_w}{\Sigma P}}{M_{wrw}-(C_p-C'_p)(t-t_w)\dfrac{(\Sigma P-p_w)}{\Sigma P}}\right\}C_p(t-t_w) \quad \ldots\ldots(15)$$

A Convenient Form for Calculating the Hydrocarbon Factor

Equation 15 can be reduced to a form which is more convenient for calculating the results from psychrometric measurements by dividing the numerator by the denominator and by keeping the M_{wr_w} term (which is the most significant) in the denominator of the resulting equation. The equation for F will then be

$$F=A+\frac{C'_p(t-t_w)(A)+C_p(t-t_w)(A^2)-C'_p(t-t_w)(A^2)}{M_{wrw}}$$
$$+\frac{(C_pC'_p-C'_p)(t-t_w)^2A^2+(C_p-C'_p)^2(t-t_w)^2A^2}{M_w^2r_w^2}$$
$$+\frac{f(C_p^2,\,C'_p{}^2,(t-t_w)^2A^2)}{M_w^2r_w^2} \quad \ldots\ldots(16)$$

It is unnecessary to carry the division any farther as it can be seen that the third as well as the fourth term is insignificant for even the most extreme conditions. (C_{p_w}=20 for specific gravity of 1.8, C'_p=8.5, $t-t_w$=40°F, and A=1, and M_wr_w=18.02×r_w) 18,000 makes the value of the third term only 0.001 which is much less than the experimental error.

Hence the equation becomes

$$F=A+\frac{C_p(t-t_w)A^2+C'_p(t-t_w)(A-A^2)}{M_{wrw}} \quad \ldots\ldots(17)$$

By assuming that A approaches the value of one which is the case for gases under pressure and at low temperatures, Equation (17) becomes the same as the C.N.G.A.-adopted equation:

$$F=A+\frac{C_p(t-t_w)}{M_{wrw}}=A+0.000053C_p(t-t_w) \quad \ldots\ldots(18)$$

However, for gases under vacuum or at high temperature or both, Eq. (17) must be used. For the purpose of rapid calculations, change Eq. (17) to:

$F=A+B\,A^2+B'\,(A-A^2)$

where $B=\dfrac{C_p(t-t_w)}{M_{wrw}}$ and $B'=\dfrac{C'_p(t-t_w)}{M_{wrw}}$ (19)

A series of A factors is given in this paper which extends the C.N.G.A. table. In addition, a series of B and B′ factors were computed and plotted on Charts II to VI. To do this the specific heat equation for hydrocarbons as given by Edminster[3] was given because it is the latest and best available data, agrees closely with the values used by the C.N.G.A. committee in 1935 to compute their B factors, and it gives, furthermore, the change in the molal heat capacity with the temperature. Chart I is a plot of the molal heat capacities at various temperatures for a range of specific gravities from 0.6 to 2.0. Since these heat capacities are accurate to about 1% and the B and B′ here will rarely amount to more than 0.050 or 0.060, an accuracy of ±0.001 of F. in the determination of these factors can be attained. Therefore, the curves for B and B′ at various temperature differences and gas gravities as shown on Charts II to VI are for an average temperature of 60°, 80°, 100°, 120°, and 140° F. respectively.

Data for the vapor pressure of water and its heat vaporization were taken from Keenan's Steam Tables (1930) and the heat capacity of water vapor was taken from Walker, Lewis, McAdams, and Gilliland (1937), p.9.

If Chart II is used for $T_{average}=\dfrac{t+t_w}{2}$ between 50° and 70°F, and t_w lies within or very near this range, Chart III for $T_{average}$ between 70° and 90°F. and t_w lies within or very near this range, etc., the variation in C_p and r_w with temperature will be limited to less than 0.001 of F for each of these temperature ranges.

Since the molal heat capacity of water vapor varies little with the temperature in this range, one chart for the factor, B′ (A—A²), is sufficient and is shown on Chart X.

Also Chart VIII contains the values of A² and A—A² for various values of A, and Chart IX gives the value of B A² for various values of B and A².

To make a computation of the factor, F, A is first found from Table I, or calculated from the equation

$$A=1-\frac{p_w}{\Sigma P}$$

then from $T_{average}=\dfrac{t+t_w}{2}$

B is found on the appropriate chart. A² and A—A² are determined from Chart VIII. B A² is found from Chart IX and B′(A—A²) is found from Chart X. The final factor, F, is found by adding A+B A²+B′(A—A²).

Discussion of the Assumptions and Approximations Made in Deriving the Above Equation

Only the third and fifth assumptions and the one pertaining to the gas leaving at the wet bulb temperature are apt to lead to any appreciable error in these computations.

If the psychrometer is well lagged between the wet and dry bulbs and the two are placed close to one another, the heat transferred to the wet bulb from the surroundings by radiation will be small. Walker, Lewis, McAdams, and Gilliland have shown that the heat of radiation received at the wet bulb will be less than 5% of the heat transferred by conduction for air velocities greater than 10 feet per second, while data in the Gas Engineers' Handbook on page 520 shows the heat of radiation to cause an error in the observed wet-bulb depression of less than 2% for wet-bulb temperatures greater than 50°F. and less than 1% for wet-bulb temperatures greater than 90°F. for velocities over 10 feet per second. The magnitude of this radiation error in most cases then is less the probable error in reading the wet-bulb depression.

The assumption of perfect gas behavior is least valid for water vapor since it is a saturated vapor in contact with its liquid. However, at the low absolute pressures encountered in the psychrometer (always 15 pounds per square inch absolute or less since even high pressure gases are run through the apparatus at atmospheric pressure) perfect gas behavior becomes closely approximated. Taking a wet bulb temperature of 150°F. as one where the most error would occur as lower temperatures would give much lower vapor pressures and consequently less error, a calculation of the volume of one pound of water vapor will show the magnitude of the error made:

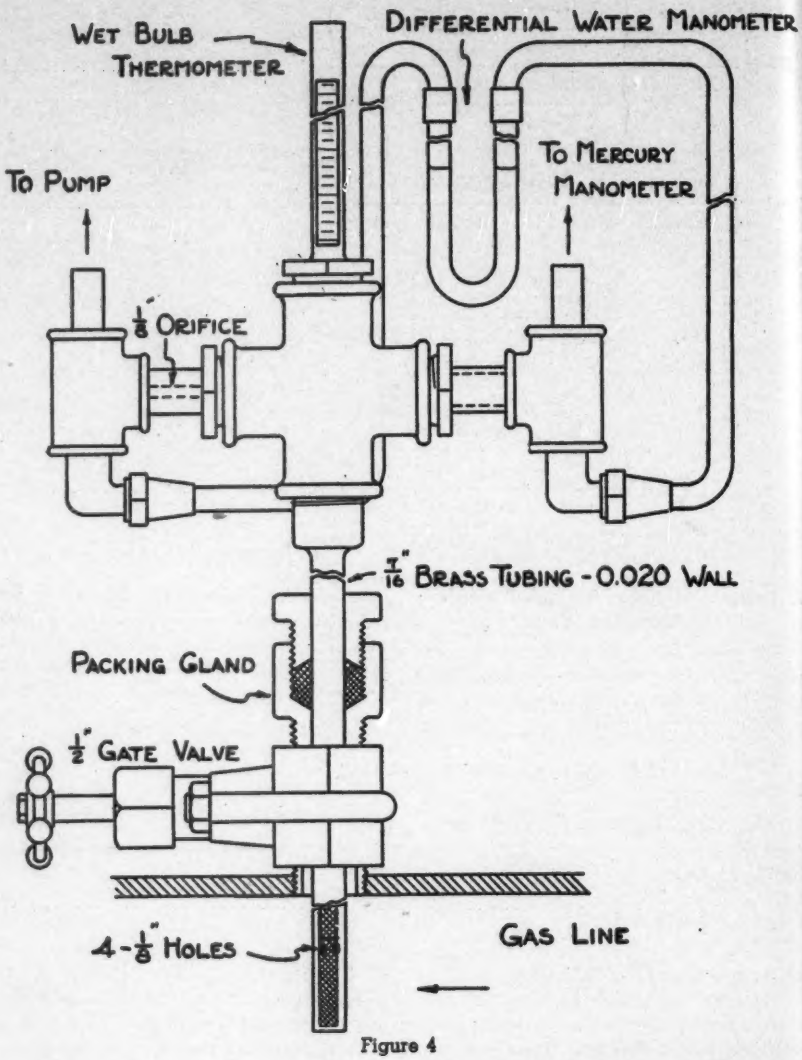


Figure 4

By the perfect gas law:

$$V=\frac{NRT}{P}=\frac{1\times10.71\times609.6}{18.02\times3.716}=97.50 \text{ cubic feet per pound}$$

P = 3.716 pound per square inch from Keenan—Steam Tables.

From Keenan—Steam Tables
V = 97.23 cubic feet per pound

$$\text{Error}=\frac{97.50-97.23}{97.23}\times100=0.28\%$$

which is much less than the error in pressure and temperature readings.

The approximation that the gas leaves the wet bulb at the wet-bulb temperature is an assumption that can only be verified by using the equation, but the nature of the construction of the apparatus gives enough turbulence to the gas to allow it to come in contact with the wet bulb and thereby assume its temperature.

The approximations made to get the present C.N.G.A. equation are only valid when the gas is saturated and shows no difference between the wet and dry bulb temperatures. As an example of the error in using the C.N.G.A. equation

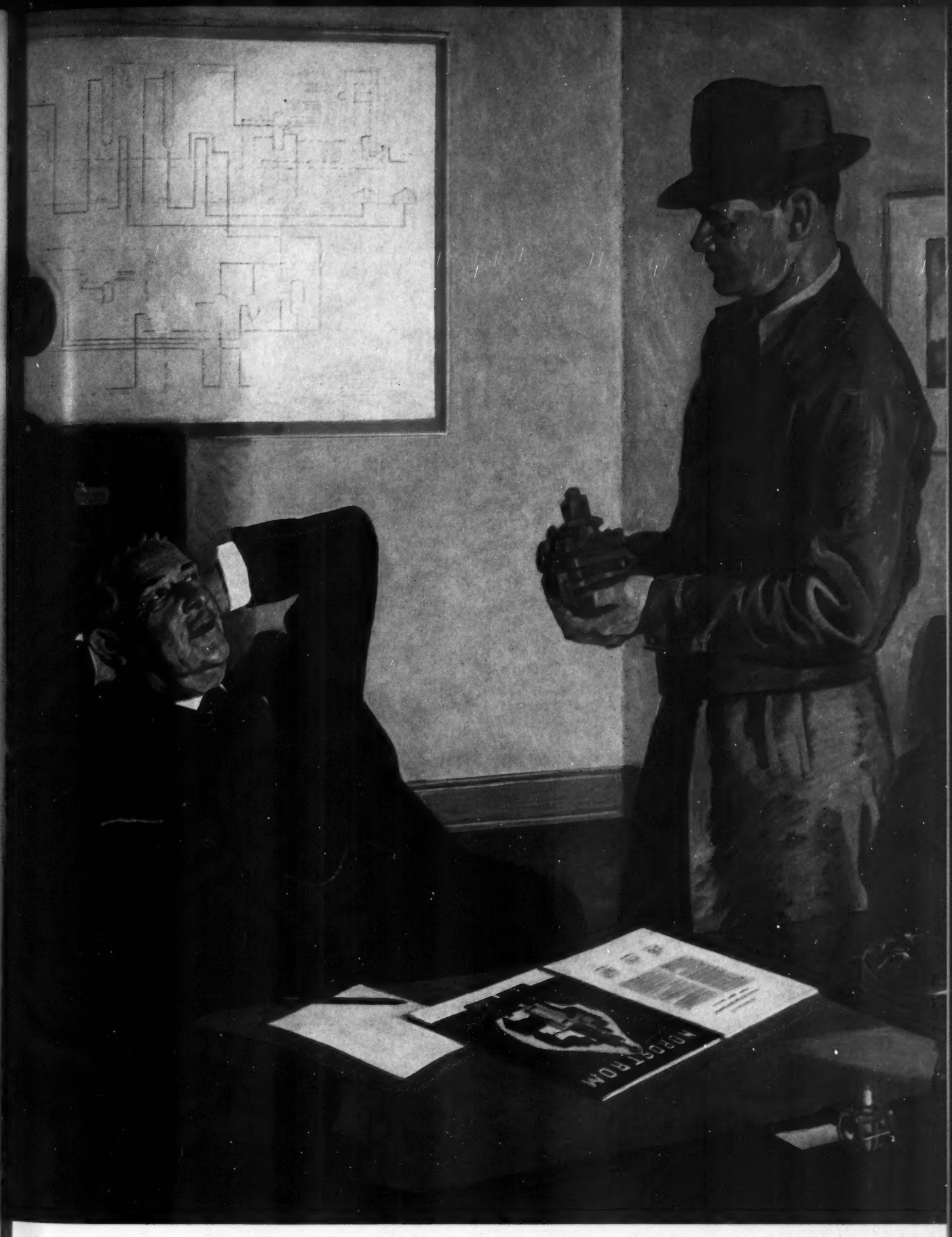
[i.e. $F=1-Ew/P+0.000053\ C_p(t-tw)$],

a gas with a specific gravity of 1.5 (C_p= 17.8 see Chart I), a dry bulb of 140°, a wet bulb of 100°, and pressure of 25 inches of vacuum (4.92 inches abs.) would give a factor of 0.645 by this equation and one of 0.625 by the new equation. The value by the C.N.G.A. would be in error by 3.2%.

This discussion also leads to a consideration of the possible accuracy of psychrometric measurements when a thermometer which can be read to ½ degree and a mercury manometer which can be read to 0.1 inch is used (since this pressure must be subtracted from the barometric reading which may also be in error, 0.1 inch is not too large an assumption). Assume that the above data should have been p=25.1 inches of vacuum, t=140½°F, and t_w=100½°F, the factor would have been 0.611 or an error of 2.3%. By similar calculations the probable error in comparable psychrometric readings may range from 0.1% at a pressure of 10 inches of mercury vacuum and a wet bulb reading of 75°F to 4% for a pressure of 25 inches of mercury vacuum and a wet bulb reading of 110° F. The percentage error here has been calculated in terms of the percentage of hydrocarbons rather than that of water vapor because the hydrocarbon, not the water vapor, factor is the desired answer.

C.N.G.A.-Approved Psychrometer Construction

All the psychrometers used in royalty testing are constructed according to the diagram in Figure 11 of C.N.G.A. Bulletin TS-351, but most of them are not lagged to prevent temperature changes



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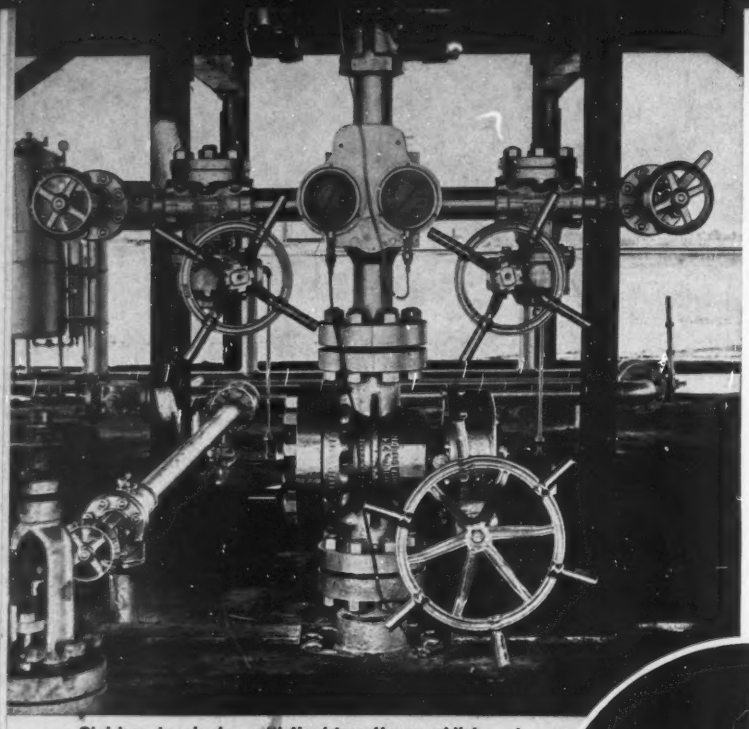
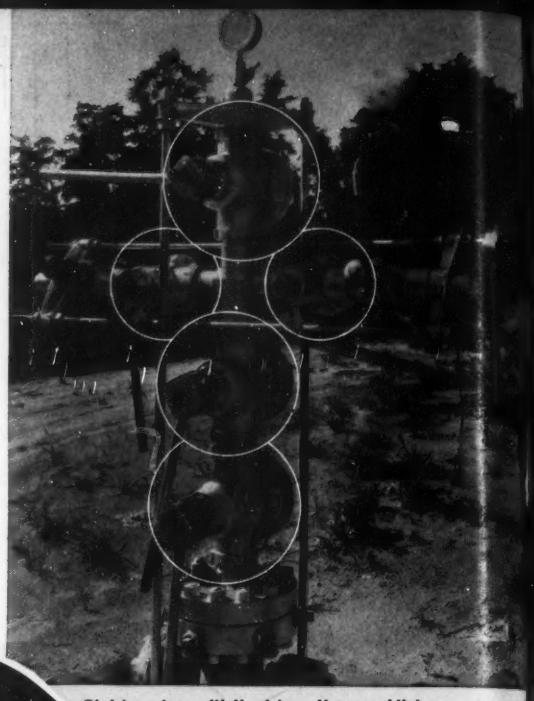
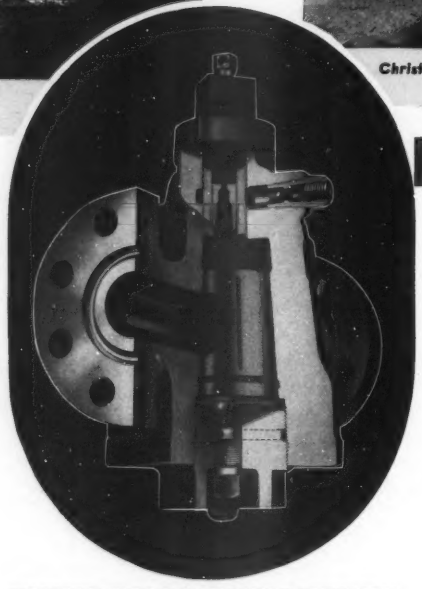


Christmas tree hook-up with Nordstrom Hypreseal Valves at Rio Bravo, California.



Christmas tree with Nordstrom Hypreseal Valves in Marion County, Texas.

CHRISTMAS TREES with NORDSTROMS are 100% *safe*



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Internal parts of the valve are totally balanced under extremely high pressures and the plug is constantly and automatically held in its seat. Easy operation and prevention of leakage are assured. At no time is there any fixed variance between the plug and the body.

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due to atmospheric conditions. They are usually connected to the line with a four foot length of rubber hose.

The possibility that the discrepancies in psychrometric readings could be eliminated by making some changes in construction led to the use of the following alteration in the apparatus:

The whole apparatus was mounted on a 12x24x¾ inch white pine plank using brass fittings as recommended in the bulletin and two charcoal thermometers with a range of 0° to 180°F which could be read easily to ½°F. A vacuum gauge which had been calibrated was used to measure the pressure. The "sampling line" was a short piece of copper tubing about one foot long connected to a ¼ inch nipple which was clamped to the board and extended vertically a short distance (about 3 inches) below the bottom edge. This feature enabled the psychrometer to be mounted directly on the ¼ inch sample valve in the gas line and have the sample line lagged as well.

Also, the orifice for measuring the rate of flow was placed after the wet and dry bulbs as there was some indication that better results would be obtained if the psychrometer pressure was as close as possible to the line pressure, and hence it would be more satisfactory to have this orifice pressure drop occur after the gas had passed the wet bulb.

The whole apparatus including the copper tubing and nipple was lagged with a ½ to ¾ inch coat of asbestos and then covered with a layer of protector coat paint. With this short sample line and complete lagging of the apparatus it was hoped that the possibility of condensation between the gas line and the dry-bulb thermometer, which is a quite probable source of error in other psychrometers, could be eliminated.

It was later found necessary to dry the gas and measure the rate with a meter as the high temperatures and high water vapor contents tested led to condensation in the manometer legs and made the reading of the differential impossible. For this reason the rates recorded in the data have been corrected from a dry basis to a wet basis as determined by the wet and dry bulb readings of psychrometer.

Method of Checking the Accuracy of the C.N.G.A.-Approved Psychrometer

There were several available methods for checking the results from this psychrometer. Comparative field tests could be made with chemical, condensation, or dew point methods against the psychrometer, but these tests would be long and tedious and are subject to question themselves as to their accuracy. Furthermore, fluctuations in line conditions during the test would lead to erratic results.

Consequently, the best method of checking results was decided to be the one shown in Figure 1. Here, samples of gas were taken from the laboratory fuel system (sp. gr. = 0.72) or were collected under high pressures in large cylinders from the wet gas sources (sp. gr. = 0.95). These gases were saturated with water vapor by bubbling them through four wash bottles in series and then to a fifth flask (E in Fig. 1) containing a little water where its temperature and pressure were accurately measured. The gas was assumed to be saturated at these conditions, and a psychrometer factor for this flask was computed to be used as a standard for comparison with values obtained from the psychrometer. Then the gas was passed through the psychrometer where its pressure and wet- and dry-bulb temperatures were taken, and the factor for this psychrometer reading could be compared with the flask factor. With this method it was possible to simulate any variety of line conditions desired, and many determinations could be made in less time and with greater accuracy than any other method available.

"Line pressures" from atmospheric to 25 inches of mercury vacuum were maintained in Flask E, while 100 readings were taken on the psychrometer at pressures varying from line pressure down to as low as was possible to obtain and still maintain a flow of gas. Since the diameter of the wet-bulb thermometer and wick was 0.3 inch and the inside diameter of the pipe fittings was 0.4 inch, calculation shows a velocity passed the wet bulb of 13 feet per second at normal barometer and tempera-

CORRECTION FOR WATER VAPOR
A FACTORS

Wet bulb °F	Absolute Pressure in Inches of Mercury														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
40	.876	.917	.938	.950	.959	.965	.969	.972	.975	.977	.979	.981	.982	.984	.985
41	.871	.914	.936	.948	.957	.963	.968	.971	.974	.977	.979	.980	.982	.983	.984
42	.866	.911	.933	.946	.955	.962	.967	.970	.973	.976	.978	.980	.981	.982	.983
43	.861	.908	.930	.944	.954	.960	.965	.969	.972	.975	.977	.979	.980	.982	.983
44	.855	.904	.928	.942	.952	.959	.964	.968	.971	.974	.976	.978	.979	.981	.982
45	.850	.900	.925	.940	.950	.957	.963	.967	.970	.973	.975	.977	.979	.980	.981
46	.844	.896	.922	.938	.948	.955	.961	.965	.969	.972	.974	.976	.978	.979	.981
47	.838	.892	.919	.935	.946	.954	.959	.964	.968	.971	.973	.975	.977	.978	.980
48	.832	.888	.916	.932	.944	.952	.958	.963	.966	.969	.972	.974	.976	.978	.979
49	.826	.884	.913	.930	.942	.950	.956	.961	.965	.968	.971	.973	.975	.977	.978
50	.819	.880	.910	.927	.940	.948	.955	.960	.964	.967	.970	.972	.974	.976	.977
51	.812	.875	.906	.924	.938	.946	.953	.958	.962	.966	.969	.971	.973	.975	.976
52	.805	.870	.902	.922	.936	.944	.951	.957	.961	.965	.968	.970	.972	.974	.976
53	.798	.865	.899	.919	.932	.942	.949	.955	.960	.964	.966	.969	.971	.973	.975
54	.790	.860	.895	.916	.930	.940	.947	.953	.958	.962	.965	.968	.970	.972	.974
55	.782	.855	.891	.913	.927	.938	.945	.952	.956	.960	.964	.966	.969	.971	.973
56	.774	.850	.887	.909	.925	.935	.943	.950	.955	.959	.962	.965	.968	.970	.972
57	.766	.844	.883	.906	.922	.933	.941	.948	.953	.957	.961	.964	.967	.969	.971
58	.757	.838	.879	.903	.919	.931	.939	.946	.951	.956	.960	.963	.965	.968	.970
59	.748	.832	.875	.899	.916	.928	.937	.944	.950	.954	.958	.961	.964	.966	.969
60	.739	.826	.870	.895	.913	.925	.935	.942	.948	.953	.957	.960	.963	.965	.967
61	.730	.820	.865	.891	.910	.923	.933	.940	.946	.951	.955	.958	.961	.964	.966
62	.720	.814	.860	.888	.907	.920	.930	.938	.944	.949	.953	.957	.960	.963	.965
63	.710	.807	.855	.884	.903	.917	.927	.936	.942	.947	.952	.955	.959	.961	.964
64	.700	.800	.850	.879	.900	.914	.925	.934	.940	.945	.950	.954	.957	.960	.962
65	.689	.793	.844	.875	.897	.911	.922	.931	.938	.943	.948	.952	.956	.959	.961
66	.678	.785	.839	.871	.893	.908	.919	.928	.936	.941	.946	.950	.954	.957	.960
67	.667	.778	.833	.866	.889	.905	.917	.926	.933	.939	.944	.949	.952	.956	.958
68	.655	.770	.827	.862	.885	.902	.914	.924	.931	.937	.943	.947	.951	.954	.957
69	.643	.762	.821	.857	.881	.898	.911	.921	.929	.935	.941	.945	.949	.952	.955
70	.631	.754	.815	.852	.877	.894	.908	.918	.926	.935	.938	.943	.947	.951	.954
71	.618	.745	.809	.846	.873	.891	.904	.915	.924	.931	.936	.941	.945	.949	.952
72	.605	.736	.803	.841	.869	.887	.901	.912	.921	.928	.934	.939	.944	.947	.951
73	.591	.727	.796	.836	.864	.883	.898	.909	.918	.926	.932	.937	.942	.946	.949
74	.577	.718	.789	.830	.859	.879	.894	.906	.915	.923	.930	.935	.940	.944	.947
75	.563	.709	.782	.824	.854	.875	.891	.903	.913	.921	.927	.933	.938	.942	.946
76	.548	.699	.774	.818	.849	.871	.887	.900	.910	.918	.925	.931	.936	.940	.944
77	.533	.689	.766	.813	.844	.867	.883	.897	.907	.915	.922	.928	.933	.938	.942
78	.517	.678	.758	.806	.839	.862	.879	.893	.903	.912	.920	.926	.931	.936	.940
79	.501	.667	.750	.799	.834	.857	.875	.889	.900	.909	.917	.923	.929	.934	.938
80	.484	.656	.742	.793	.828	.853	.871	.885	.897	.906	.914	.921	.927	.931	.936
81	.467	.645	.734	.786	.822	.848	.867	.882	.894	.903	.912	.918	.924	.929	.934
82	.449	.633	.725	.779	.816	.843	.863	.878	.890	.900	.909	.916	.922	.927	.931
83	.431	.621	.716	.772	.810	.838	.858	.874	.886	.897	.906	.913	.919	.924	.929
84	.412	.608	.707	.764	.804	.832	.853	.869	.883	.894	.902	.910	.916	.922	.927
85	.393	.595	.697	.756	.798	.827	.848	.865	.879	.890	.900	.907	.914	.920	.925
86	.373	.582	.687	.748	.791	.821	.843	.861	.875	.887	.896	.904	.911	.917	.922
87	.353	.569	.677	.740	.784	.815	.838	.856	.871	.883	.893	.901	.908	.914	.920
88	.333	.555	.667	.732	.777	.809	.833	.852	.867	.879	.889	.898	.905	.911	.917
89	.311	.541	.656	.723	.770	.803	.828	.847	.862	.875	.886	.894	.902	.908	.914
90	.289	.526	.645	.714	.763	.797	.823	.842	.856	.871	.882	.891	.899	.906	.912

CORRECTION FOR WATER VAPOR

A FACTORS

Wet Bulb of	Absolute Pressure in Inches of Mercury															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
40	.985	.986	.987	.988	.988	.989	.989	.990	.990	.990	.991	.991	.992	.992	.992	.992
41	.985	.986	.986	.987	.988	.988	.989	.989	.990	.990	.990	.991	.991	.991	.992	.992
42	.984	.985	.986	.987	.987	.988	.988	.989	.989	.990	.990	.990	.991	.991	.991	.992
43	.984	.985	.985	.986	.987	.987	.988	.988	.989	.989	.990	.990	.990	.991	.991	.991
44	.983	.984	.985	.986	.986	.987	.988	.988	.988	.989	.989	.990	.990	.990	.991	.991
45	.982	.983	.984	.985	.986	.986	.987	.988	.988	.988	.989	.989	.990	.990	.990	.991
46	.982	.983	.984	.984	.985	.986	.987	.987	.988	.988	.988	.989	.989	.990	.990	.990
47	.981	.982	.983	.984	.985	.985	.986	.987	.987	.988	.988	.988	.989	.989	.990	.990
48	.980	.981	.982	.983	.984	.985	.985	.986	.987	.987	.988	.988	.988	.989	.989	.990
49	.979	.981	.982	.983	.983	.984	.985	.986	.986	.987	.987	.988	.988	.988	.989	.989
50	.979	.980	.981	.982	.983	.984	.984	.985	.986	.986	.987	.987	.988	.988	.989	.989
51	.978	.979	.980	.981	.982	.983	.984	.984	.985	.986	.986	.987	.987	.987	.988	.988
52	.977	.978	.980	.980	.982	.982	.983	.984	.984	.985	.986	.986	.987	.987	.988	.988
53	.976	.978	.979	.980	.981	.982	.982	.983	.984	.984	.985	.986	.986	.987	.987	.987
54	.975	.977	.978	.979	.980	.981	.982	.982	.983	.984	.984	.985	.986	.986	.986	.987
55	.974	.976	.977	.978	.979	.980	.981	.982	.983	.983	.984	.984	.985	.985	.986	.986
56	.973	.975	.976	.977	.978	.980	.980	.981	.982	.983	.983	.984	.984	.985	.985	.986
57	.972	.974	.975	.977	.978	.979	.980	.980	.981	.982	.982	.983	.984	.984	.985	.985
58	.973	.973	.974	.976	.977	.978	.979	.980	.981	.981	.982	.983	.983	.984	.984	.985
59	.970	.972	.974	.975	.976	.977	.978	.979	.980	.981	.981	.982	.982	.983	.984	.984
60	.969	.971	.973	.974	.975	.976	.977	.978	.979	.980	.981	.981	.982	.983	.983	.984
61	.968	.970	.972	.973	.974	.975	.976	.976	.978	.979	.980	.981	.981	.982	.983	.983
62	.967	.969	.971	.972	.973	.975	.976	.977	.978	.978	.979	.980	.981	.981	.982	.982
63	.966	.968	.970	.971	.972	.974	.975	.976	.977	.978	.979	.979	.980	.981	.981	.982
64	.965	.967	.968	.970	.971	.973	.974	.975	.976	.977	.978	.979	.979	.980	.981	.981
65	.964	.966	.967	.969	.970	.972	.973	.974	.975	.976	.977	.978	.979	.979	.980	.981
66	.962	.964	.966	.968	.969	.971	.972	.973	.974	.975	.975	.977	.978	.979	.979	.980
67	.961	.963	.965	.967	.968	.970	.971	.972	.973	.974	.974	.976	.977	.978	.978	.979
68	.960	.962	.964	.966	.967	.969	.970	.971	.972	.974	.974	.975	.976	.977	.978	.978
69	.958	.960	.962	.964	.966	.968	.969	.970	.972	.973	.973	.975	.975	.976	.977	.978
70	.957	.959	.961	.963	.965	.966	.968	.969	.970	.972	.972	.974	.975	.975	.976	.977
71	.955	.958	.960	.962	.964	.965	.967	.968	.970	.971	.971	.973	.974	.975	.975	.976
72	.954	.956	.958	.960	.962	.964	.966	.967	.968	.970	.971	.972	.973	.974	.975	.975
73	.952	.955	.957	.959	.961	.963	.965	.966	.967	.969	.970	.971	.972	.973	.974	.975
74	.950	.953	.956	.958	.960	.962	.963	.965	.966	.968	.969	.970	.971	.972	.973	.974
75	.949	.952	.954	.956	.958	.960	.962	.964	.965	.966	.967	.969	.970	.971	.972	.973
76	.947	.950	.952	.955	.957	.959	.961	.962	.964	.965	.966	.968	.969	.970	.971	.972
77	.945	.948	.951	.953	.956	.958	.960	.961	.963	.964	.965	.967	.968	.969	.970	.971
78	.944	.947	.949	.952	.954	.956	.958	.960	.962	.963	.964	.966	.967	.968	.969	.970
79	.942	.945	.948	.950	.953	.955	.957	.958	.960	.962	.963	.964	.966	.967	.968	.969
80	.940	.943	.946	.949	.951	.953	.955	.957	.959	.960	.962	.963	.965	.966	.967	.968
81	.938	.941	.944	.947	.949	.952	.954	.956	.958	.959	.961	.962	.963	.965	.966	.967
82	.936	.939	.942	.945	.948	.950	.952	.954	.956	.958	.959	.961	.962	.963	.965	.966
83	.933	.937	.940	.943	.946	.948	.951	.953	.955	.956	.958	.960	.961	.962	.964	.965
84	.931	.935	.938	.941	.944	.947	.949	.951	.953	.955	.957	.958	.960	.961	.962	.964
85	.929	.933	.936	.939	.942	.945	.948	.950	.952	.954	.955	.957	.958	.960	.961	.962
86	.927	.931	.934	.938	.941	.943	.946	.948	.950	.952	.954	.956	.957	.958	.960	.961
87	.924	.928	.932	.935	.939	.942	.944	.946	.948	.950	.952	.954	.956	.957	.958	.960
88	.922	.926	.930	.933	.937	.940	.942	.945	.947	.949	.951	.952	.954	.956	.957	.958
89	.919	.924	.928	.931	.935	.938	.940	.943	.945	.947	.949	.951	.953	.954	.956	.957
90	.917	.921	.925	.929	.933	.936	.938	.941	.943	.946	.946	.950	.951	.953	.954	.956

ture when a volume of 0.3 cubic feet per minute was recorded.

Discussion of Results on the C.N.G.A.-Type Psychrometer

These tests show the marked inconsistency in results as has been experienced by other investigators on C.N.G.A. psychrometric work. Even the use of the new equation, while giving more satisfactory results, would not eliminate the major portion of the discrepancies.

Despite the lagging of the instrument and the short, lagged sample line, it was found impossible to prevent condensation in the apparatus, for the dry bulb reading never equaled the known inlet, or "line", temperature. This condition led to factors which were too high when the psychrometer pressure was near the line pressure. While, on the other hand, factors that were too low were recorded for psychrometer pressures which were much lower than the "line" pressures. These conditions prevailed even for gas at ambient temperatures.

It was hoped that it might have been possible to find some psychrometer pressure which would yield correct results for a given line pressure as the factors are first too high and then too low as the psychrometer pressure is gradually reduced from that of the line. However, no correlation between these pressures could be determined as the fluctuations were very erratic.

The instrument requires an excessively long time to come to equilibrium and even then does not give good results.

For some specific line conditions, these C.N.G.A.-adopted instruments will give consistent, but not correct, results for various psychrometer pressures, while at slightly different line conditions the results will be very erratic.

By these tests the C.N.G.A.-type psychrometer shows errors of as much as 10 to 15% and therefore can not be considered a reliable test for the water vapor content of a gas.

Development and Testing of a New Type of Psychrometer Construction

From the fact that the dry-bulb temperature of the C.N.G.A.-type psychrometer in high vacuum and high temperature work never reaches that of the line, it was reasoned that an instrument which would give a dry-bulb temperature equal to the line temperature might eliminate the discrepancies found in the present apparatus, especially if the length of sample line were reduced. A psychrometer which could be placed directly in the line carrying the gas and yet allow the proper gas velocity past the wet bulb would accomplish this, and an instrument of that type was constructed as shown in Fig. 2. This instrument can be set in the gas line through a ½ inch tap, and the gas then pumped through the opening near the bottom of the ½ inch copper tube and around the wet bulb. This instrument would give the wet-bulb temperature, while the line temperature would give the dry-bulb temperature.

Preliminary Laboratory Tests

To test this apparatus in the laboratory as a check on its accuracy, a somewhat similar set-up was made of glass tubing having three side arms and allowing the gas to pass from an opening in the bottom of the tube, around the wet bulb, and out one of the side arms. One of the other two side arms was used as a pressure tap, and the other as a reservoir for the wetted wick. (See Figure 3.) A thermometer was placed in Flask F in order to secure the dry-bulb bulb temperature.

The data for this apparatus were secured in the same manner as the C.N.G.A.-type psychrometer data were taken. The rate was maintained the same as before as the dimensions of this tube and wet bulb were almost identical with those used in the C.N.G.A.-type psychrometer. The gas was saturated with water, and tests were made for its water vapor content when it was superheated to unsaturated conditions and when it was throttled to unsaturated conditions but maintained at line temperature by placing the flask in the water bath along with the saturation flasks. Also, for some of the tests a little water was placed in the bottom of Flask F to determine the accuracy of the psychrometer for saturated conditions.

Discussion of Results With the New Psychrometer

These 188 laboratory runs show excellent agreement between "line" factors and psychrometer factors. Out of nearly two hundred determinations, 92%

of the readings checked to 1.0% or better, while all but three checked to 2.0% or better. The laboratory runs also show that the new instrument gives wet-bulb temperatures to an accuracy of ½° F or better for conditions of complete water saturation of the gas as it goes to the wet and dry bulbs of the psychrometer. Most field wet gases are completely saturated with respect to water vapor.

The new equation gives more satisfactory results than the present C.N.G.A. one, especially where the degree of unsaturation is great. Since it does give better results and has a better theoretical background, its use is to be recommended.

As the mass velocity of gas past the wet bulb is the important factor, there is some indication in these results that gases of low specific gravity (here, it is 0.72) should be run at velocities of 15 to 20 feet per second for good results, while for gases of high specific gravity (i.e., greater than 1), velocities of 10 feet per second are satisfactory.

Due to friction of the gas flowing through the laboratory set-up, the psychrometer pressures for gases superheated to unsaturated conditions are sometimes much less than the line pressures for the same run. The results from runs of this type and ones where the gas was deliberately throttled to unsaturated conditions tend to indicate that still more satisfactory results could be obtained if the psychrometer pressure equaled the line pressure. Hence, where the instrument as shown in Figure 2 is used in the field, there would be little restriction to the flow of gas before it struck the wet bulb, and the psychrometer pressure would be very close to line pressure. This condition should lead to results accurate to better than 1%.

Comparative Tests on Wells

To apply these facts found in the laboratory experiments to field work, the gas from a number of wells in the Santa Fe Springs field was tested for water vapor content with this new instrument in the same manner as it would have been used during a charcoal test. Three wells having the highest line temperatures in this particular field were chosen, and those temperatures ranged from 103 to 119°F. with a corresponding vacuum of 16 to 17 inches of mercury.

Two of the wells gave exactly the same factor with the new instrument as would be calculated for saturated line conditions at the known line pressure and temperature, while a third, with a line temperature of 119½°F, showed less than saturated conditions.

CORRECTION FOR WATER VAPOR
A FACTORS

Wet Bulb °F	Absolute Pressure in Inches of Mercury														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
91	.867	.811	.634	.705	.756	.791	.817	.837	.854	.867	.878	.888	.896	.903	.909
92	.844	.496	.622	.696	.748	.784	.811	.832	.849	.863	.874	.884	.892	.900	.906
93	.220	.480	.610	.687	.740	.777	.805	.827	.844	.859	.870	.880	.889	.896	.903
94	.195	.464	.598	.677	.732	.770	.799	.822	.839	.854	.866	.877	.885	.893	.900
95	.170	.447	.585	.667	.724	.763	.793	.816	.834	.850	.862	.873	.882	.890	.897
96	.144	.430	.572	.657	.715	.756	.786	.810	.829	.845	.858	.869	.878	.886	.893
97	.118	.412	.559	.646	.706	.748	.779	.804	.824	.840	.854	.865	.874	.883	.890
98	.091	.394	.545	.635	.697	.740	.773	.798	.818	.835	.849	.861	.871	.879	.887
99	.063	.375	.531	.624	.688	.732	.766	.792	.813	.830	.844	.856	.867	.875	.883
100	.034	.356	.517	.612	.678	.724	.758	.786	.807	.825	.840	.852	.862	.872	.880
101	.005	.336	.502	.600	.668	.716	.751	.779	.801	.820	.835	.847	.858	.868	.876
102		.316	.487	.588	.658	.707	.744	.772	.795	.814	.830	.843	.854	.864	.872
103		.296	.472	.576	.648	.698	.736	.765	.789	.808	.824	.838	.850	.860	.868
104		.275	.456	.563	.637	.689	.728	.758	.783	.803	.819	.833	.845	.855	.864
105		.253	.440	.550	.626	.680	.720	.751	.776	.797	.814	.828	.840	.851	.860
106		.230	.423	.536	.615	.670	.712	.744	.769	.790	.808	.822	.835	.846	.856
107		.207	.406	.522	.604	.660	.703	.736	.762	.784	.802	.817	.830	.841	.851
108		.184	.388	.508	.592	.650	.694	.728	.755	.778	.796	.812	.825	.837	.847
109		.160	.370	.494	.580	.640	.685	.720	.748	.771	.790	.806	.820	.832	.842
110		.135	.351	.479	.568	.630	.676	.712	.741	.764	.784	.800	.815	.827	.838
111		.110	.332	.464	.555	.619	.666	.703	.733	.757	.778	.794	.810	.822	.833
112		.084	.313	.448	.542	.608	.656	.694	.725	.750	.771	.788	.804	.817	.828
113		.057	.293	.432	.529	.596	.646	.686	.717	.743	.764	.782	.798	.812	.823
114		.030	.272	.416	.515	.584	.636	.677	.709	.736	.757	.776	.792	.806	.818
115		.002	.251	.399	.501	.572	.626	.668	.701	.728	.750	.770	.786	.800	.813
116			.230	.382	.487	.560	.615	.658	.692	.720	.743	.763	.780	.795	.808
117			.208	.364	.472	.548	.604	.648	.683	.712	.736	.756	.774	.789	.802
118			.185	.346	.457	.535	.593	.638	.674	.704	.729	.749	.768	.783	.796
119			.162	.327	.442	.522	.581	.628	.665	.695	.721	.742	.761	.777	.791
120			.139	.308	.426	.508	.569	.617	.655	.687	.713	.735	.754	.771	.785
121			.115	.289	.410	.494	.557	.606	.646	.678	.705	.728	.747	.764	.779
122			.090	.269	.393	.480	.545	.595	.636	.669	.697	.720	.740	.757	.772
123			.064	.248	.376	.465	.532	.584	.626	.660	.688	.712	.733	.750	.766
124			.038	.227	.359	.450	.519	.573	.616	.651	.679	.704	.726	.743	.760
125			.012	.206	.341	.435	.506	.561	.605	.641	.670	.696	.718	.736	.753
126				.184	.323	.420	.492	.549	.594	.631	.661	.688	.710	.729	.746
127				.162	.305	.404	.478	.537	.583	.621	.652	.679	.702	.722	.739
128				.139	.286	.388	.464	.524	.571	.611	.643	.670	.694	.714	.732
129				.116	.266	.371	.449	.511	.559	.600	.633	.661	.685	.706	.725
130				.092	.246	.354	.435	.498	.547	.589	.623	.652	.677	.698	.718
131				.067	.226	.336	.419	.484	.535	.578	.615	.643	.668	.690	.710
132				.042	.205	.318	.403	.470	.523	.567	.605	.633	.659	.682	.702
133				.016	.184	.300	.387	.456	.510	.555	.592	.623	.650	.674	.694
134					.162	.281	.371	.441	.497	.543	.581	.613	.541	.665	.686
135					.139	.262	.354	.426	.484	.531	.570	.603	.631	.656	.678
136					.117	.253	.337	.411	.470	.518	.559	.592	.621	.647	.669
137					.093	.223	.320	.395	.456	.505	.547	.581	.611	.638	.660
138					.069	.202	.302	.379	.442	.492	.535	.570	.601	.628	.651
139					.045	.181	.284	.363	.427	.479	.523	.559	.591	.618	.642
140					.020	.160	.265	.347	.412	.465	.510	.548	.580	.608	.633

The C.N.G.A.-type psychrometer gave results which varied as much as 4% of the hydrocarbon factor among themselves and showed as much as 25% less water vapor than did the new instrument, again indicating condensation in the sample line. These discrepancies occurred in spite of the fact that this C.N.G.A.-type psychrometer had several improvements which gave somewhat better results than the ordinary type apparatus as a series of tests made by the members of the Charcoal Test Committee No. 6 on May 24, 1939 showed.

Comparative Tests on Blowers

It soon became evident that these tests on wells would not furnish much more useful data because of the lack of comparative standards by which to judge the accuracy of the results. If such a test run showed saturated line conditions, then the new equipment could not be proved for large wet and dry bulb temperature differences, and the validity of the new equation could not be shown as both the C.N.G.A. and the new equation gave the same form when there is no difference between the wet and dry bulb temperature readings. If a test run showed unsaturated conditions, there was no satisfactory check method available for determining the correct water vapor content.

Consequently, it was decided to test a series of blowers on both the suction and the discharge sides and compare the two factors from these tests. It was assumed that the heating effect from compression would be great enough to prevent the condensation of water, and the same hydrocarbon factor should hold for both sides. Subsequent line temperature and pressure measurements proved this assumption to be valid. Unfortunately, only three available blowers among the different oil companies in this region had ½ inch sample taps on both the up- and down-stream sides

CORRECTION FOR WATER VAPOR
A FACTORS

Wet Bulb °F	Absolute Pressure in Inches of Mercury															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
91	.914	.919	.923	.927	.930	.934	.936	.939	.942	.944	.946	.948	.950	.951	.953	.954
92	.911	.916	.921	.924	.928	.932	.934	.937	.940	.942	.944	.946	.948	.950	.951	.953
93	.909	.914	.918	.922	.926	.929	.932	.935	.938	.940	.942	.944	.946	.948	.950	.951
94	.906	.911	.916	.920	.924	.927	.930	.933	.936	.938	.940	.943	.945	.946	.948	.950
95	.903	.908	.913	.917	.921	.925	.928	.931	.934	.936	.939	.941	.943	.945	.947	.948
96	.900	.906	.910	.914	.919	.923	.926	.929	.932	.934	.937	.939	.941	.943	.945	.947
97	.897	.902	.908	.912	.916	.920	.924	.927	.930	.932	.935	.937	.939	.941	.943	.945
98	.893	.899	.905	.909	.914	.918	.921	.924	.928	.930	.935	.935	.938	.939	.942	.943
99	.890	.896	.902	.906	.911	.915	.919	.922	.925	.928	.931	.933	.936	.938	.940	.942
100	.887	.893	.899	.903	.908	.912	.916	.920	.923	.926	.929	.931	.934	.936	.938	.940
101	.883	.890	.896	.900	.905	.910	.914	.917	.921	.924	.926	.929	.932	.934	.936	.938
102	.880	.886	.892	.897	.902	.907	.911	.915	.918	.921	.924	.927	.930	.932	.934	.936
103	.876	.883	.889	.894	.899	.904	.908	.912	.916	.919	.922	.925	.927	.930	.932	.934
104	.872	.879	.886	.891	.897	.901	.906	.910	.913	.916	.920	.922	.925	.927	.930	.932
105	.869	.876	.882	.888	.894	.898	.903	.907	.911	.914	.917	.920	.923	.925	.928	.930
106	.864	.872	.878	.885	.890	.895	.900	.904	.908	.911	.914	.918	.920	.923	.926	.928
107	.860	.868	.875	.881	.887	.892	.897	.901	.905	.909	.912	.915	.918	.921	.923	.926
108	.856	.864	.871	.878	.883	.889	.894	.898	.902	.906	.910	.913	.916	.918	.921	.923
109	.852	.860	.867	.874	.880	.885	.890	.895	.899	.903	.907	.910	.913	.916	.919	.921
110	.847	.856	.863	.870	.876	.882	.887	.892	.896	.900	.904	.907	.911	.914	.916	.919
111	.843	.852	.859	.867	.873	.879	.884	.889	.893	.897	.901	.905	.908	.911	.914	.917
112	.836	.848	.855	.863	.869	.875	.880	.885	.890	.894	.898	.902	.905	.908	.911	.915
113	.834	.843	.851	.859	.865	.871	.877	.882	.887	.891	.895	.899	.902	.906	.909	.912
114	.829	.838	.847	.854	.861	.868	.873	.879	.884	.888	.892	.896	.900	.903	.906	.909
115	.824	.834	.843	.850	.857	.864	.870	.875	.880	.885	.889	.893	.897	.900	.903	.906
116	.819	.829	.838	.846	.853	.860	.866	.872	.877	.882	.886	.890	.894	.897	.901	.904
117	.814	.824	.833	.842	.849	.856	.862	.868	.874	.879	.883	.887	.891	.894	.898	.901
118	.809	.819	.828	.837	.845	.852	.858	.864	.870	.875	.879	.884	.888	.891	.895	.898
119	.803	.814	.824	.832	.840	.848	.854	.860	.866	.871	.876	.880	.884	.888	.892	.895
120	.798	.809	.819	.828	.836	.843	.850	.856	.862	.868	.872	.877	.881	.885	.889	.892
121	.792	.804	.814	.823	.831	.839	.846	.852	.858	.864	.869	.874	.878	.882	.886	.889
122	.786	.798	.808	.818	.827	.834	.842	.848	.854	.860	.865	.870	.874	.879	.883	.886
123	.780	.792	.803	.813	.822	.830	.837	.844	.850	.856	.862	.866	.871	.875	.879	.883
124	.774	.786	.798	.808	.817	.825	.833	.840	.846	.852	.858	.863	.867	.872	.876	.880
125	.768	.780	.792	.803	.812	.820	.828	.836	.842	.848	.854	.859	.864	.868	.872	.876
126	.762	.774	.786	.797	.807	.815	.823	.831	.838	.844	.850	.855	.860	.865	.869	.873
127	.755	.768	.780	.792	.802	.810	.818	.826	.834	.839	.845	.851	.856	.861	.865	.870
128	.748	.762	.774	.786	.796	.805	.813	.821	.829	.836	.841	.847	.852	.857	.862	.866
129	.741	.756	.768	.780	.790	.800	.808	.816	.824	.831	.837	.843	.848	.853	.858	.862
130	.734	.749	.762	.774	.785	.795	.803	.812	.819	.826	.832	.838	.844	.849	.854	.859
131	.727	.742	.755	.768	.779	.789	.798	.806	.814	.821	.828	.834	.840	.845	.850	.855
132	.720	.735	.749	.762	.773	.783	.793	.801	.809	.816	.823	.830	.835	.841	.846	.851
133	.712	.728	.742	.755	.767	.777	.787	.796	.804	.811	.819	.825	.831	.837	.842	.847
134	.704	.721	.735	.748	.760	.771	.781	.791	.799	.806	.814	.820	.827	.832	.838	.843
135	.696	.713	.728	.742	.754	.765	.775	.785	.794	.801	.809	.816	.822	.828	.833	.839
136	.688	.705	.721	.735	.748	.759	.769	.779	.788	.796	.804	.811	.817	.823	.829	.834
137	.680	.693	.714	.728	.741	.753	.763	.773	.782	.791	.798	.806	.812	.819	.824	.830
138	.672	.690	.706	.721	.734	.746	.757	.767	.777	.786	.793	.801	.807	.814	.820	.825
139	.663	.682	.698	.714	.727	.739	.751	.761	.771	.780	.788	.795	.802	.809	.815	.821
140	.654	.673	.690	.706	.720	.733	.745	.755	.765	.774	.782	.790	.797	.804	.810	.816

which would be suitable for this new apparatus.

On a blower in the Santa Fe Springs field, satisfactory results were obtained even where the gas on the discharge side was at 209°F. Comparative tests with the C.N.G.A.-type psychrometer were also made.

Factors of 0.833 and 0.831 were determined for the suction side before and after, respectively, taking comparative tests with the C.N.G.A.-type psychrometer. A factor of 0.824 was obtained for the discharge side, but an immediate recheck of the suction side showed it to have fallen to 0.826, a difference of only 0.2% from the factor for the discharge side.

The C.N.G.A. - type psychrometer showed from 4.4% to 7.4% difference between the two sides for the hydrocarbon factor.

On a blower in the Signal Hill field, the new psychrometer showed factors of 0.803 and 0.800 on the suction side for tests before and after comparative tests with the C.N.G.A.-adopted instrument were made. These values checked those calculated for saturated conditions to 0.1%. While on the discharge side, values of 0.799 and 0.802 were obtained before and after comparative tests were made, and assuming saturated conditions for the suction side, a factor of 0.800 was calculated from the temperature and pressure prevailing on the suction side during the time the tests were made on the discharge side. This is an accuracy of 0.2%. The C.N.G.A.-type psychrometer, under these conditions showed as much as 8.6% difference from the calculated line conditions.

On another blower in the Signal Hill field, two members of the Charcoal Test Committee made some comparative runs at the same time the new apparatus was tried. One of the committeemen used two instruments, one made of ¼ inch fittings and the other of ⅜ inch fittings. Due to the constant fluctuation of the pressure on the discharge side, it was impossible to obtain a pressure reading to closer than ½ inch of mercury and consequently to get a wet bulb temperature reading to better than 2 degrees. Despite this difficulty, the new apparatus checked to 1.9% (this could be reduced to 0.1% for a wet bulb reading of 1½°F lower), while the C.N.G.A.-type apparatus gave results which deviated from

HUMIDITY MEASUREMENTS ON VARIOUS WELLS AT SANTA FE SPRINGS—COMPARISON OF THE NEW AND THE OLD APPARATUS

Data—Location Date Bar. Press		Type of Psychrometer	Line Pressure in Inches Hg. Vac.	Line Temp. in °F	Psychrometer Pressure in Inches Hg. Vac.	Dry Bulb Temp. in °F	Wet Bulb Temp. in °F	Rate in ft. ³/m	F Factor for the Line	F Factor for Psy. F_P	F Factor for Psy. F_{CNGA}
6-30-39 Bar. P. = 29.95" Sp. Gr. = 1.1	12 Noon to 1:30 P.M.	In Line	16.15	119½	16.35	.....	112	0.46	0.754	0.802	0.804
		CNGA	.....	.....	20.2	97	96	0.29	.....	0.824	0.824
		CNGA	.....	.....	22.2	97	87½	0.24	.....	0.835	0.837
		CNGA	.....	.....	24.4	96	75	0.18	.....	0.854	0.855
	2:00 P.M. to 3 P.M.	CNGA	.....	.....	17.2	105½	105	0.32	.....	0.824	0.824
		CNGA	.....	.....	20.1	102½	97½	0.26	.....	0.821	0.821
		CNGA	.....	.....	22.4	102	90	0.20	.....	0.819	0.820
		CNGA	.....	.....	24.4	101	81	0.15	.....	0.819	0.821
		In Line	16.55	116½	16.6	.....	111½	0.46	0.767	0.800	0.800
7-2-39 11:30A.M. to 1:00P.M. Bar. P. = 29.95" Sp.Gr. = 1.1		In Line	16.05	114	16.2	.....	113¼+	0.35	0.791	0.791	0.791
		CNGA	.....	.....	16.8	108½	108	0.37	.....	0.814	0.814
		CNGA	.....	.....	20.1	101½	101	0.26	.....	0.798	0.798
		CNGA	.....	.....	22.5	95	93	0.15	.....	0.792	0.792
		CNGA	.....	.....	24.5	90½	82	0.09	.....	0.803	0.804
		In Line	16.5	114–	16.7		113½	0.38	0.784	0.784	0.784
7-2-39 1:00P.M. to 2:00 P.M. Bar. P. = 29.95" Sp.Gr. = 1.1		In Line	17.05	103	17.2	.....	102½	0.41	0.837	0.837	0.837
		CNGA	.....	.....	17.8	102½	98	0.37	.....	0.853	0.853
		CNGA	.....	.....	20.2	99	91	0.32	.....	0.855	0.856
		CNGA	.....	.....	22.5	97	83½	0.20	.....	0.853	0.854
		CNGA	.....	.....	24.5	94½	74½	0.13	.....	0.853	0.854
		In Line	17.2	103	17.4	.....	102½	0.36	0.834	0.834	0.834

COMPARATIVE TESTS ON VARIOUS BLOWERS WITH NEW AND OLD TYPE APPARATUS

Data—Location Date Bar. Press		Type of Psychrometer	Line Pressure in inches Hg. Vac.	Line Temp. in °F	Psychrometer Pressure in inches Hg. Vac.	Dry Bulb Temp. in °F	Wet Bulb Temp. in °F	Rate in ft. ³/m	F Factor for the Line	F Factor for Pay. F_P	F Factor for Pay. F_{CNGA}
Signal Oil and Gas Co.— 7-14-39 10 A.M. to 12 Noon Bar. P. =30.0" Sp. Gr. =1.6	Suction Side of Blower	In Line	26.1	91	26.1	85½	84	0.11	0.624	0.700	0.700
		Signal Pay	26.1	91	26.4	86	84	.....	0.624	0.675	0.675
		Texas ¼ inch	26.1	91	26.6	83	79	.....	0.624	0.706	0.709
		Texas ⅛ inch	26.1	91	26.5	83	79½	.....	0.624	0.712	0.713
	Discharge Side of Blower	In Line	16.5±0.5	135	16.5±0.5	.....	128±2	0.49	0.618	0.687	0.688
		Signal Pay	16.5	135	17.0	119	111	.....	0.618	0.801	0.801
		Texas ¼ inch	16.5	135	25.0	88	87	.....	0.618	0.742	0.742
		Texas ⅛ inch	16.5	135	17.0	106	106	.....	0.618	0.822	0.822
		Texas ¼ inch	16.5	135	26.4	88	84	.....	0.618	0.676	0.677
		Texas ⅛ inch	16.5	135	17.0	114	112	.....	0.618	0.789	0.789
Gen. Pet. Corp.— K & H Lease Signal Hill Bar. P. =30.0"	Suction Side of Blower	In Line	23.7	85½	23.75	.....	85½	0.25	0.804	0.803	0.803
		CNGA	.....	.....	24.1	83	83	0.24	.....	0.807	0.807
		CNGA	.....	.....	25.0	82	79½	0.20	.....	0.799	0.799
		CNGA	.....	.....	26.0	81	76	0.19	.....	0.777	0.777
		In Line	23.75	86	23.85	.....	85½	0.28	0.800	0.800	0.800
	Discharge Side of Blower	In Line	15.9	154	16.0	.....	116½	0.39	0.408	0.799	0.798
		CNGA	.....	.....	19.9	106	103½	0.39	.....	0.790	0.790
		CNGA	.....	.....	16.9	111	110½	0.53	.....	0.799	0.799
		CNGA	.....	.....	22.0	102½	97½	0.30	.....	0.779	0.779
		CNGA	.....	.....	24.4	99	89½	0.21	.....	0.754	0.756
		CNGA	.....	.....	26.2	95	80½	0.15	.....	0.731	0.734
		In Line	15.9	157½	16.1	.....	116	0.40	0.356	0.802	0.800
Gen. Pet. Corp.— Jalk Lease— Springs 7-14-39 Bar. P. =29.95" Sp. Gr. =1.2	Suction Side of Blower	In Line	23.15	90½	23.2	.....	83½	0.16	.....	0.833	0.834
		CNGA	.....	.....	.....	115	80½	0.15	.....	0.796	0.798
		CNGA	.....	.....	.....	108	82	0.10	.....	0.787	0.789
		CNGA	.....	.....	.....	105	82½	0.13	.....	0.781	0.783
		In Line	23.15	99	23.15	.....	84½	0.17	.....	0.831	0.834
	Discharge Side of Blower	In Line	15.2	209	15.3	.....	119½	0.49	.....	0.824	0.820
		CNGA	.....	.....	16.4	119	106	0.39	.....	0.838	0.838
		CNGA	.....	.....	20.0	117	96	0.25	.....	0.841	0.841
		CNGA	.....	.....	22.3	110	88½	0.17	.....	0.836	0.836
		CNGA	.....	.....	24.6	105	78½	0.09	.....	0.833	0.833
	Suction Side of Blower	In Line	23.3	90	23.3	.....	84	0.12	.....	0.826	0.827

the suction line conditions by from 4.8% to 18.5%.

These tests have shown the new instrument to be reliable to better than ½% where satisfactory sampling conditions are available and further work should prove its worth.

Comparative Tests on Various Blowers With New and Old Type Apparatus

Conclusions

A more exact equation for computing the hydrocarbon factor has been deduced, and its application has been found to be especially important for high vacuums and large wet bulb depressions. The equation and accompanying charts are given in the form of the present A and B factors used by the C.N.G.A. Where there are large differences between the wet and dry bulb temperatures or where high vacuums exist, the use of the present C.N.G.A. equation leads to errors of as much as 2 and 3% which this new equation can eliminate. However, even the use of this new form will not account for more than a small part of the gross inconsistencies of the present C.N.G.A. psychrometer.

The C.N.G.A.-adopted apparatus will not give reliable results when testing gases under vacuum, the error being as much as 15 to 20% of the hydrocarbon fraction with this same error appearing in the final gasoline content report. A number of precautions were taken to assure the best possible operating conditions such as an accurate calibration of the vacuum gauge, reading of temperatures of ½°F., maintaining a rate of 10 feet per second or better past the wet bulb (although this was found to be a minimum, rather than a critical velocity), and maintaining the wetted wick in good condition. It was found impossible to adapt any set of operating conditions which would increase its consistency or accuracy, and improvements in construction, such as lagging the instrument, shortening and lagging the sample line, and reducing the pressure and temperature drop between the line and the wet bulb failed to improve the accuracy of the results appreciably.

A new type of psychrometer so constructed that the wet bulb can be inserted directly into the gas line has given very satisfactory results. Laboratory runs indicate that it is accurate to 1%, while field runs, where conditions are more favorable, indicate an accuracy of 0.2%. The final form of the instrument should be as shown in Figure 4. Using a ½ inch sample tap and gate valve, the brass tube of the instrument is inserted through a packing gland to the gate on the valve, the packing gland tightened lightly, the valve opened, the instrument inserted far enough to allow the ⅛ inch openings on the tube to come near the center of the gas line, and the packing gland given a final tightening. The gas is then pumped through the four ⅛ inch openings, around the wet bulb, and through the orifice to measure the rate. Two taps on either side of the orifice lead to a differential water manometer, and a third goes to a mercury manometer where the pressure can be read to 0.1 inch of mercury. A special thermometer which is calibrated to ⅛ degrees and has an immersion long enough to accommodate all that part of the thermometer which is in the flowing gas stream is required. The water reservoir can be filled before each test by merely dipping the end of the tube in a bottle of water and allowing it to fill to the ⅛ inch holes. The new instrument coupled with the new equation should show excellent results with further testings.

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Lane-Wells Holds General Sales Meeting

The general officers and division executives of the Lane-Wells Co. met in Los Angeles Jan. 8 to 12 for the Annual General Sales Meeting of the company.

According to Rodney S. Durkee, president of Lane-Wells, the company operations for 1940 will include an aggressive sales campaign as well as the construction of new field units for Gun Perforating and Electrolog needed for the expansion of these Services in all fields.

Under the direction of M. E. Montrose, general sales manager, the 1940 sales campaigns for each of the company's divisions were set. The development of the company's Service during the past year in the Mid-Continent and Gulf Coast areas demands an increase of both men and equipment in these fields during the coming year.

Representing the Gulf Coast Division at the meeting were Morton T. Higgs and J. D. Hughes, division manager and sales manager, respectively, at Houston. Manager J. W. McPhee and Sales Manager D. M. Anderson represented the California Division.

LAUGH THIS OFF

Discussing the oil business with a mogul who really ought to know something about it, we found him very optimistic over the future. However, at the same time he seemed to be badly worried over the fact that maybe his optimism wasn't justified.

And speaking of optimism, says **Max App** when his shirt came back from the laundry, "Oh, well, we were gonna have to buy some lace curtains anyhow."

Mac McKinnon, the Sage of Taft, once defined optimists and pessimists in the following descriptive way: "An optimist is a guy, who, every time he opens an oyster, expects to get a pearl. A pessimist, on the other hand, under the same circumstances expects to get ptomaine poisoning."

Whereupon **George Thompson** springs this fine example of efficiency in the oil business: The equipment salesman approached the receptionist, and with a note of triumph in his voice announced, "I have an appointment with the manager. Where is his office?" Came the reply, "Well, you go along that corridor, until you see a door with 'No Admittance' on it. Go through that and you'll come to another door, with a sign on it saying, 'Keep Out.' Go through that one, too, and when you come to one more with 'Silence' on it, just yell for him."

And, of course, as **Bill Roper** has always contended, economy is merely a way of spending money without getting any fun out of it.

Bill's pet anathema, incidentally, is the small town motor cop who hides behind the "Welcome" sign.

And uses a soft pencil to make the charge look as black as possible.

Now diverging again as is our wont, **Johnny Dresser,** the quarter inch superintendent, tells us about an Irishman up in Kettleman Hills who shaves three times a week on week days, and once a day on Sundays.

Which recalls the fact that Junior fell down badly in a natural history exam recently when he defined lava as "stuff the barber puts on your face before he shaves you."

And when **Gene Arnold,** the Maricopa gauger, spilled carbon bisulphide on his shirt, he felt like thirty scents.

Gene, you will remember, is the lad who pointed out that a dromedary has two humps, but a camel has only one, the same as a highway pipeline crossing.

Which simply shows that you should never burn your Camels at both ends.

That brings up the subject of smoking, and reminds us of **Ray Tatum's** experience. Says Ray to the clerk in the cigar store. "Gimme a cigar, please." Asks the clerk, "Five or ten?" Replies Ray, "Naw, one is plenty."

It is interesting to note, too, that Ray now has his golf score down even with his bowling score, which makes it so much easier to remember.

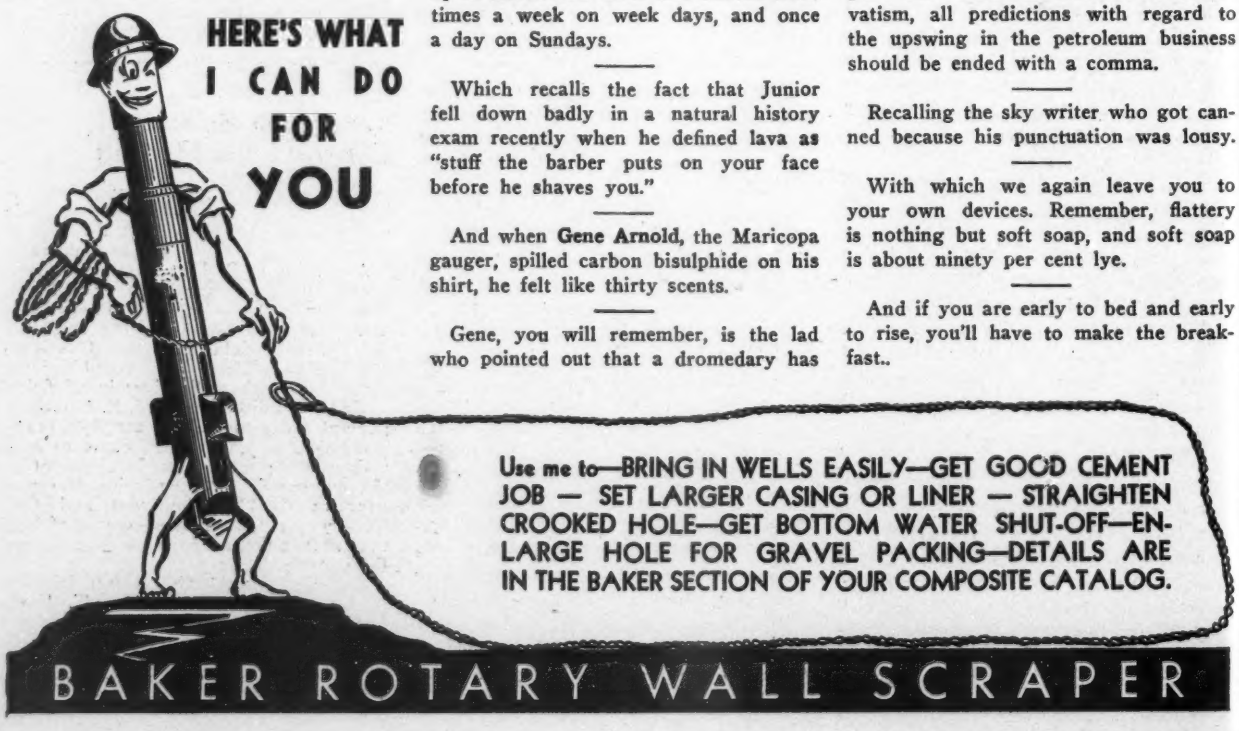
When a collector called at his home recently, soliciting aid for the "League to Suppress Profanity," Ray's boy who had answered the door, called, "Hi, mom, here's a guy wants to buy pop's golf clubs."

Gene Hill at this point interrupts to point out that in the interests of conservatism, all predictions with regard to the upswing in the petroleum business should be ended with a comma.

Recalling the sky writer who got canned because his punctuation was lousy.

With which we again leave you to your own devices. Remember, flattery is nothing but soft soap, and soft soap is about ninety per cent lye.

And if you are early to bed and early to rise, you'll have to make the breakfast..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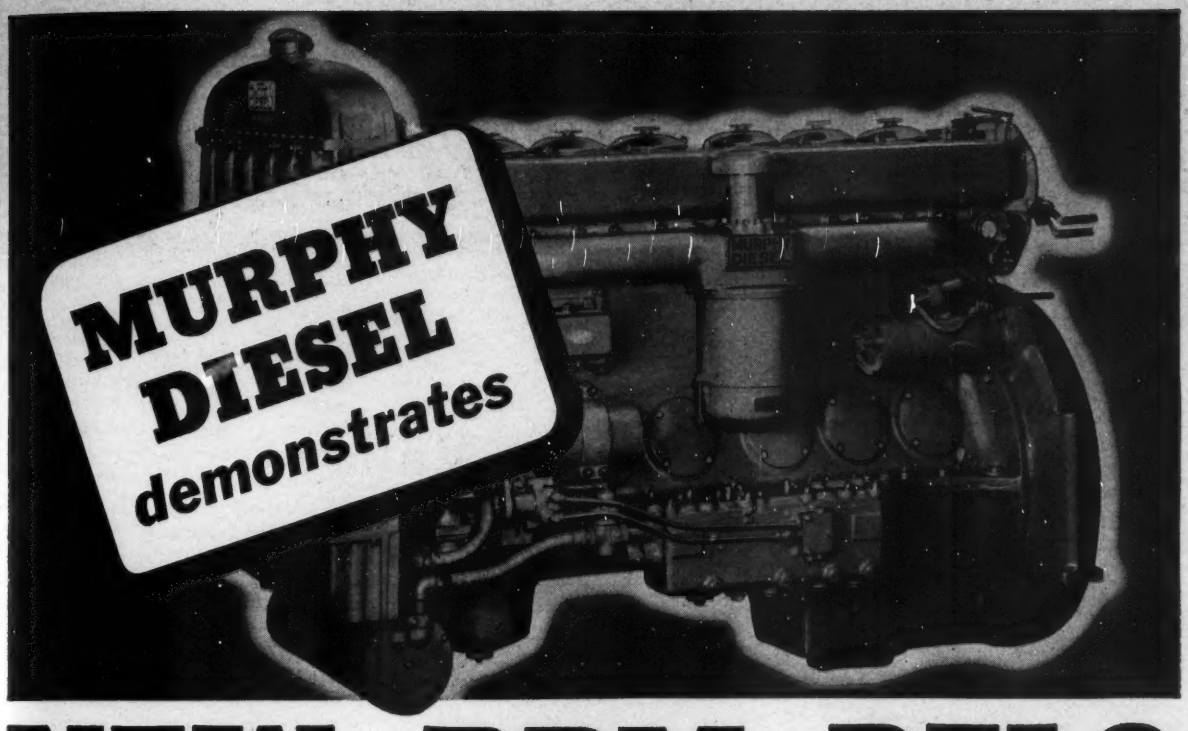

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And New RPM DELO *took it*—kept cylinders clean—kept rings free—kept oil filters clean—and showed not the least sign of corrosion on bearings. Carbon and sludge?—there weren't any!

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STANDARD OIL COMPANY OF CALIFORNIA

Field Development

San Joaquin Valley

Western Gulf Drills Through Paloma Oil Sand

Bottomed in shale at 10,422 ft. after coring Stevens oil sand from 10,083 ft. to 10,353 ft., Western Gulf Oil Co. is running 8⅝ in. casing on its second Paloma field well, KCL No. A-74-3. Drilled some 1500 ft. east of it's discovery well, KCL A-54-3, the company may make more hole, after landing casing, to properly explore the deep zone.

The discovery well, drilled by Western Gulf in conjunction with The Texas Co., is located near the center of sec. 3,32-26 on large, jointly held leases. Completed in late August, 1939, the well initialed 2246 barrel rate on a five hour test. The oil exceeded 50 gravity due to the condensate from 15,000,000 cubic feet of gas.

Third well in the area is being drilled by the Ohio Oil Co. which is drilling KCL No. B-2-43-3 at 8905 ft., just one location north of the original well.

Standard Abandons Greeley Outpost

What appeared in July of 1939 as a major addition to Rio Bravo zone production at Greeley has been washed out as a wet, edgey outpost well. Spudded in December of 1938, Standard Oil Co.'s KCL No. 12-6 was drilled to 11,942 ft. near the center of sec. 30,29-26, which point is a mile southwest of south Greeley production. Completed in July, 1939 from a plugged depth of 11,885 ft. after losing a core barrel on bottom, the well made a potential test of 4214 barrels of 37 gravity oil cutting 7.0% fresh water. Beaned back to conform with conservation figures, the cut steadily increased to a point where fresh water production exceeds the oil, and as a consequence the well is no longer profitable. Preparations are under way to officially abandon.

Counterbalancing the loss however, is Standard's recent northerly extension development. With KCL No. 12-5 in sec. 7,29-26 flowing an initial 3425 barrels of clean 37.5 gravity oil from the Vedder zone, and two other wells in the section well on the way to the pro-

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
Cantua Creek	The Texas Co., S.P.	1	23, 17-15	4805	Drilling
Coalinga	Coalinga Pacific Oil Co., S.P.A.	7	6, 21-15		Location
	Lewis, C. H.	1	18, 21-15	800	Idle
	Migs Oil Co.	8	11, 20-14		Location
	Rylatt, Harry E., Kipling	3	26, 20-14	2010	Idle
	Wilshire Annex Oil Co.	64-30B	30, 19-16	8383	Suspended
Gatos Creek	Gatos Creek Oil Co.	1	19, 19-13	466	Idle
Huron	The Texas Co., Boston	1	14, 20-18		Grade
Mendota	Jergins Oil Co., Cheney Ranch	1	29, 14-13	5658	Drilling
	Kern County				
Antelope	Par Petroleum Co.	1	32, 25-17	3032	Idle
Belridge—South	Union Oil Co., Fitzgerald-Weston	1	13, 29-21		Location
Buena Vista	Gen. Pet. Corp., B.V.A.	1	1, 32-24	10760	Drilling
	Richfield Oil Corp., B.V.A.	81-36	36, 31-25	11379	Plugged 5460—Testing
	Shell Oil Co., B.V.A.	45-9	9, 32-25	9886	Redrilling
Buttonwillow	Union Oil Co., Bowerbank	4-23	23, 29-24	12144	Plugged 11,770—Testing
Devil's Den	Herzog, Raymond D.	1	27, 25-18	710	Idle
	The Texas Co., Beer	2	8, 26-19	1140	Drilling
Edison	El Tejon Oil & Ref. Corp., Douglas	2	32, 29-29	866	Drilling
	Goodrum & Vincent, Inc., S.P.	3	31, 29-30	200	Drilling
	Mayes, A. S.	1	5, 30-29	4222	Fishing
	O'Reilly, Francis, Edison-Land	2	5, 30-29	4103	Plugged 4070—Idle
	Whiston, H. L., Wasem	1	32, 29-29	2202	Drilling
Jasmine	Amerada Pet. Corp., Corehole	H	13, 25-27	1823	Abandoned
	Bolling Oil Co.	1	15, 25-27		Location
Kern Front	Davis Petroleum Co.	1	13, 28-27	1295	Prep. to deepen
Kern River	Sleeper Ridge Oil Co.	1	15, 29-28	1797	Idle
McKittrick	Burt & Taylor, Taylor	1	30, 30-22	1047	Idle
	Calstan Pet. Co., Webber	1	34, 30-22	1220	Drilling
	Deal, O. T., M.&M.	1	30, 30-22	6664	Idle
Panorama Hills	Burrhus, V. E.	2	31, 31-22		Rig
San Emigdio	Shell Oil Co. KCL 2A	52-13	13, 11-22	13145	Drilling
Shafter	Continental Oil Co., Comm.	1	12, 28-24	2822	Drilling
Shale Hills	Gamble & Oliver, Abbott	1	7, 27-19	1966	Drilling
	The Texas Co., McD-Theta	1	12, 28-19		Rigging up
Ten Section	Richfield Oil Corp., James-Slough KCL	1	6, 31-26	9556	Drilling
	Kings County				
Kettleman—South Dome	Bristol Oil Co., Smith	1	35, 24-19	8054	Cleaning out
Reef Ridge	Chuka Oil Co.	2A	10, 23-16	185	Idle
W. Tulare Lake	Shell Oil Co., Cohn Estate	6-4	4, 22-19	7628	Drilling
Strattford	P. W. Burnham & Assoc., Bartells	1	23, 20-20		Rig

ductive sands, Standard has off-set its loss.

Standard Completes Wasco Deep Well

With but 36 ft. open to bottom at 13,130 ft. Standard Oil Co. completed Mushrush No. 3 in the Wasco field. Flowing from the extremely prolific A-2 sand, the well established a 3300 barrel potential through a 20/64 in. bean and 698,000 cubic feet of gas. The 36.3 gravity oil was made with pressure needles indicating 975 pounds on the tubing and 1000 pounds on the casing. Conjecture as to the ultimate production with an open flow may be based upon the performance of Continental Oil Co.'s KCL No. A-4-8 which flowed at a 9200 barrel rate on a potential test in March, 1939.

The field is being operated upon a strict basis, for it is feared that due to tightly packed sands gas exhaustion will definitely terminate the productivity of the field. This opinion is predicated upon experiences in some portions of Kettleman North Dome which has sands and conditions roughly parallel. In these areas production curves show no tendency to flatten, but continue down to an abrupt and unproductive end.

Richfield Testing B. V. Lake Gas Sands

After drilling to 11,376 ft. in search of oil production, Richfield Oil Corp. has plugged BVA No. 81-36 to 5560 ft. for tests of the Tulare-Paso Robles gas sands which proved fruitful when tried on the way down. Located at the easterly edge of the Buena Vista Lake bed near the tip of the Buena Vista gas field in sec. 36,31-25, the well exhausted all possibilities to and included the Stevens zone before relinquishing the search for oil. Tested from 5405 to 5580 ft. during drilling operations, the well made a 12,500,000 cubic ft. rate gas flow. After plugging back, the 11¾ in. casing was perforated from 5548 to 5532 ft. and the well flowed 8,000,000 cubic foot rate through a 2-in. bean. Perforations are now being made for more tests higher in the hole.

General Petroleum Corp.'s B.V.A. No. 1, surviving lake area oil test, is drilling at 10,760 ft. in hard brown shale. Located between the Buena Vista Hills and the lake, in sec. 1,32-24, the well has shown few indications of oil and the possibility of discovery so low on structure seems remote.

Still conceded a chance at Stevens zone production due to having picked up the Chert much higher than the other wells, is Shell Oil Co.'s BVA No. 45-9 at the south edge of the lake in sec. 8,32-25. The well is redrilling at 9716 ft. after losing a 9886 ft. hole due to caving formations and a protective string was cemented at 7990 ft. to prohibit a recurrence.

You are reading the Pacific Coast oil men's home paper.

Texas Co. Completes Midway-Sunset Well

Pumping 150 barrels of 23 gravity oil in 16 hours from 72 ft. of zone to bottom at 3209 ft., The Texas Co. finished well No. 37 in sec. 32,32-24 of the Midway-Sunset field.

Jerome Bihl's well No. 2A, in sec. 7, 11-23, is pumping small amounts of emulsified oil from 2410 ft. Other ac-

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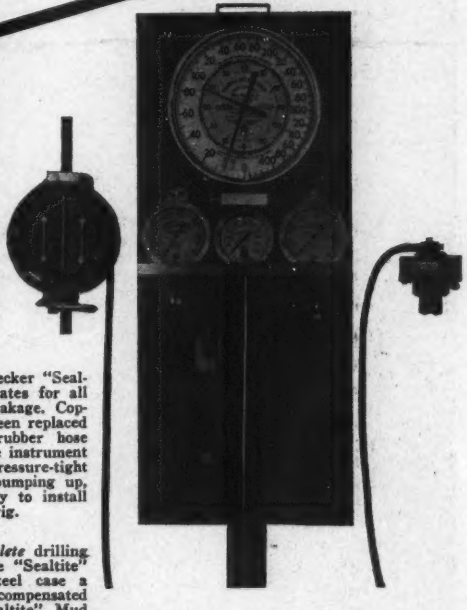

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MID-CONTINENT DISTRIBUTION — REED ROLLER BIT COMPANY, HOUSTON, TEXAS

tivity planned for section 7 is Iroquois Oil Co.'s No. 3 location for which has just been made.

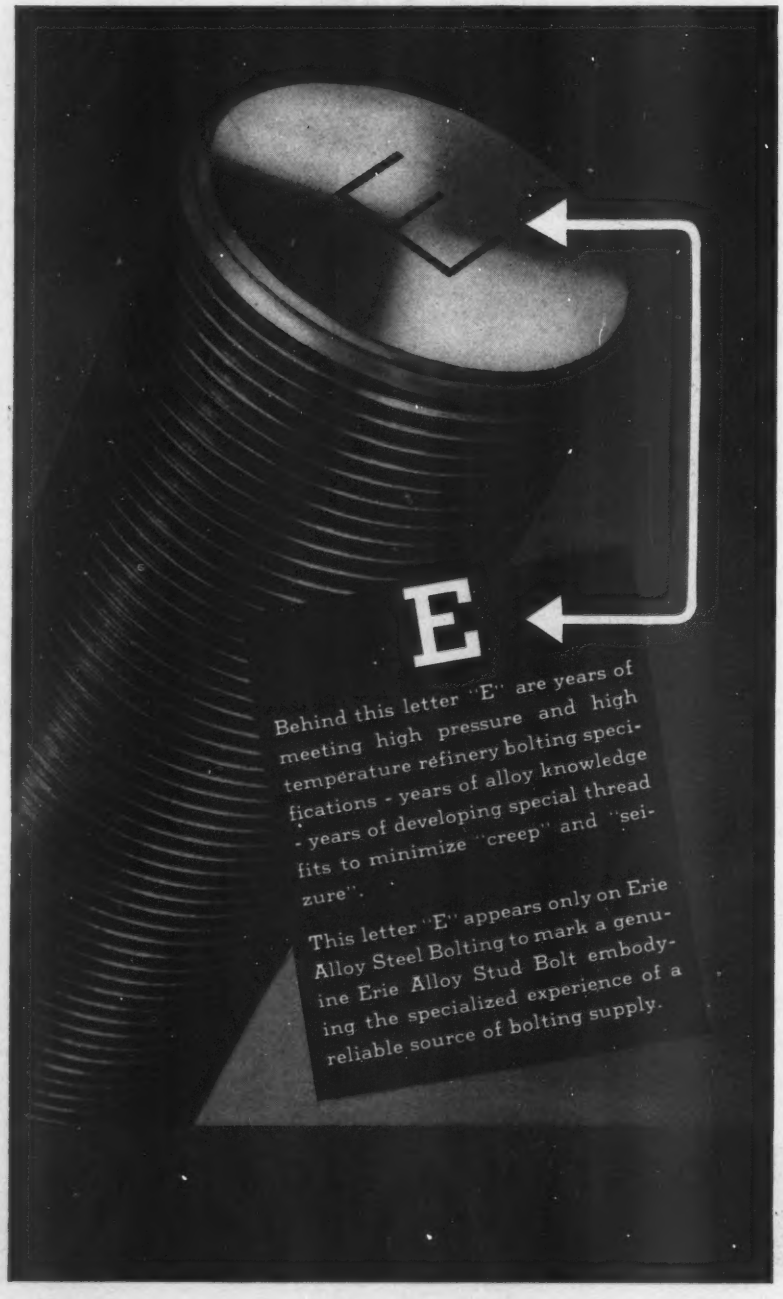
In sec. 15,32-23 Robert A. Foster has erected rig for Hollingsworth No. 1 while in sec. 35,32-23 National Oil Co. has carried well No. 35 to oil sand at 1105 ft. and Signal Oil & Gas Co. is in gray shale and tar sand at 520 ft. with Kendon No. 8.

Merritt Annex Oil Co.'s No. 1-34 is drilling sec. 34,32-24 below 2600 ft. while its No. 8 in sec. 25,12-24 is idle at 2495 ft. Joseph McDonald plans to drill well No. 19 in sec. 26,31-22 while the Oxford Oil Co. has completed No. 7 pumping a fair amount of oil in section 27 of the township. Standard Oil Co. has built rig for No. 6-33D in sec. 33, 32-24.

Union Swabs Fresh Water

With 5¾ in. casing recemented at 11,662 ft. and the 12,144 ft. hole cleaned out to 11,770 ft. Union Oil Co. is swabbing through a formation tester on Bowerbank No. 4-23. Recovery from the open interval has been semi-fresh water of 20 grains titration, with the fluid standing at 7000 ft.

The history of the well, located in sec. 23,29-24, closely follows that of the four mile distant and abandoned California Exploration Co.'s 12,989 ft. Salisbury No. 1. Many strata of tightly packed, seemingly impermeable sands have been encountered, tests of which, in the Salisbury well, failed to show much kick and were loath to yield the little oil they contained.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Jergins Mystery Well Yet Drilling

The well being drilled by the Jergins Oil Co. on a structure some 24 miles northwest of Coalinga in the Mendota area is reported to be in sandy shale below 5640 ft. Known as Cheney Ranch No. 1, the project was located on sec. 29,14-13 by the relatively little used method of soil analysis; accounting no doubt for the secrecy surrounding the results of drilling operations. While accurate data is unavailable, usually reliable sources place the top of the Kreyenhagen near 3100 ft. and the Domengine sands at 4525 ft. with no oil showings present to date.

Continental Oil Spuds Shafter Try

Locating Community No. 1 near the northeast quarter of sec. 1,28-24, Continental Oil Co. is trying for Shafter area production on a southeasterly line drawn from the Wasco field. Continental, aided by other operators, has previously drilled deep tests on this general trend. Nearest of the deep holes, Kernco No. 36-1, is but a mile and a half northwest of the current effort, and was drilled to a barren 12,985 ft. by the Union Oil Co. with the financial assistance of Tide Water Associated, Seaboard and Continental Oil Companys. With 13⅜ in. surface pipe cemented at 1000 ft. the hole is drilling below 2500 ft. in sandy shale and sand.

Texas Co. Drilling Cantua Creek Test

The relentless search for oil production in the northern reaches of Fresno county is continued with the spudding of The Texas Co.'s S.P. No. 1 in sec. 23,17-15. Drilled to barren Cretaceous by many wildcat tests, the area has maintained its place in the wildcatters heart by presenting a beautiful surface picture and by having yielded a small amount of 35.8 gravity oil to the Western Gulf Oil Co. in its test of sec. 3, 17-15.

The Texas Co.'s well is drilling below 4800 ft. on a location lying between the Western Gulf showings and the Shell Oil Co.'s Port Costa No. 48-30 in sec. 30,17-16 which drilled to barren Cretaceous at 10,711 ft.

Whiston Drilling North Edison Try

In sec. 32,29-29 a quarter of a mile north of the El Tejon O & R Co. Douglas No. 1 which was recently completed pumping 150 barrels of 17 gravity oil from a plugged depth of 3945 ft., H. L. Whiston is drilling Wasem No. 1 below 1900 ft. just west of the original well, El Tejon's Douglas No. 2 was last reported at 860 ft. while A. S. Mayes, who is redrilling well No. 1 across the line in sec. 5,30-29, is fishing drill pipe after remaking 3475 ft. of hole. Francis O'Reilly, operator of Edison Land Co. No. 2 in section 5, is idle after twisting off drill pipe. The well, one of the first to start, had been plugged to 4070 ft. and found wet at 3960 ft. when the twistoff occured.

Huron Area To Get Deep Test

Excavations for Boston No. 1 are under way on sec. 14,20-18 of Fresno county. Located in what is commonly called the Huron area, near the Fresno-Kings county line, the test will be drilled by The Texas Co. Little drilling had been done in the district and no wells have been carried to the deep zones. The current project is held to offer excellent chances at production from both the Miocene and Eocene formations.

Bristol Oil Working South Dome Veteran

Smith No. 1, an 8054 ft. hole drilled in the early days of South Dome development by the Ohio Oil Co., has been cleaned out to 5400 ft. by Bristol Oil Co. A wooden derrick was erected over the hole in sec. 35,24-19 and following the clean-out an attempt was made to run a Strato-Graph which hung up midway the hole. Last reported as cleaning out to re-run the instrument, the operators plan to gun-perforate and test showing indicated by the device.

Union Plans South Belridge Extension

Location has been made for a test 1½ miles southeast of the South Belridge field. The well, Fitzgerald-Weston No. 1, will be drilled by Union Oil Co. on sec. 13,29-21. Small, isolated oil accumulations have been found between this field and the McKittrick, and it is possible that in the event a direct extension is not established a new pool may be struck.

Cuyama Valley Try Hung-Up

O. K. Hearte has abandoned well No. 1 at 2902 ft. after bottoming in sandy shale without encountering showings. Located in sec. 11,9-25 of Santa Barbara county, the effort was the first to be drilled within a radius of several miles.

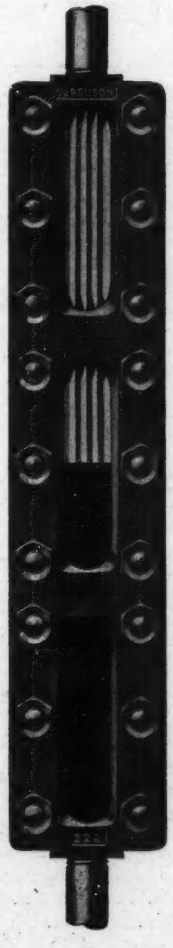
Shell Co. Enters Deep Tulare Zone

Entering the deep zones hitherto untested at the westerly limits of the Tulare Lake bed, Shell Oil Co. is spot coring Cohn Estate No. 6-4 below 7600 ft. Located in sec. 4,22-19, the well is situated 5 miles northeast of the south tip of the North Kettleman Dome field in an area long felt to deserve an adequate test.

Amerada Abandons Jasmine Area Try

The exploratory hole, Corehole No. H, drilled in the southeast quarter of sec. 13,25-27 of the Jasmine area by Amerada Petroleum Corp., has been abandoned at 1823 ft. in wet sands thought to be the Walker.

JERGUSON



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Los Angeles Basin

San Francisco No. 8 Flows From Third Zone

With an initial of 840 bbls. a day, Barnsdall Oil Co. completed its eighth well in the Rancho San Francisco lease in the Newhall-Potrero field west of Newhall. Producing only the third zone, the hole is open from the shoe of the 7 in. casing at 7150 ft. to bottom at 7373 ft. The oil is 35 gravity and cuts less than 1.0% water.

Preparations are being made to drill No. 9 approximately 600 ft. west of No. 7.

New Montebello Drilling Permit Policy

Meeting on January 2 the Montebello City Council stated that in the future it will not approve drilling permits on locations less than 75 feet from street boundaries, unless it is physically impossible to maintain that distance. Where the 75 foot distance cannot be enforced, the council will be governed by ordinance, and grant a permit within 50 feet of street boundaries.

Goleta Well Tests Shallow Gas Sand

W. C. (Ham) Hamilton, Long Beach operator, ran a formation test on a gray sand interval cored from 435 to 460 ft. in his test of the old Goleta field. A small quantity of gassy mud was recovered and the project is being cored ahead below 775 ft.

Important Wildcats Test Los Angeles Basin

Several important wildcat wells are preparing to drill in the Los Angeles Basin and Newhall areas.

Leading in popular interest is Gus Pongratz Oil Co.'s Dominguez extension test which is preparing to spud on the Grant property east of Main St. and north of Walnut. Recent developments in the Avalon Blvd. portion of the field test to indicate Miocene production will be found at least as far west as Pongratz' location.

Just spudding in is Dominguez Estate Co.'s exploratory well on fee property a third of a mile west of Western Ave. and a mile north of the old Torrance field. The company believes production may be found either at the Pliocene-Miocene contact or in an equivalent of the Del Amo zone. Some geologists believe there is a chance of finding oil at the top of the schist as in El Segundo.

In the northwesterly section of the San Fernando Valley, Continental Oil Co. is almost ready to spud Howell No. 1 on a lease from the San Fernando Mission Land Co. The project is located a little north of the two wells drilled by Standard Oil Co. in the early 1920's which found showings but were not completed. On the same structure but farther east, Shell Oil Co. drilled two wells, the first of which looked like it might become a producer.

At Newhall, Tamas Oil Co., now reported backed by a large independent company, is setting casing, presumably for protecting the hole which is down nearly 4000 ft. without even surface pipe. On an extension of Pico Anticline in sec. 6,3-16, Canyon Oil Co.'s derrick is standing idle.

Interest is keen in C. C. Worland's Jenkins-Owens No. 1, located in sec. 18,5n-16w near the Ridge Route. Drilling now at approximately 500 ft., the well will test a well defined structure which gives promise of production above 2500 ft.

One of the most interesting wildcats of the Basin proper is that of El Rey Oil Co. which is being rigged up at the northwest corner of Imperial Highway and Western Ave. A brand new butane type drilling outfit is being installed by drilling contractor J. E. Pettijohn with the expectation of carrying the hole to at least 8500 ft. in search of Miocene oil sands similar to the 7th and 8th Callender zones of Dominguez and Rosecrans. The operators have made arrangements to receive major company assistance.

A new concern, formed in Santa Ana, called Plainview Oil Co. is planning to drill a deep hole about a mile north of the town of Westminster in Orange county. L. H. Benningsdorf, who has drilled many wells at Huntington Beach, will be in charge of field operations.

With the expectation of spudding within a few days, Vanguard Oil Co. is rigging up its likely looking wildcat near Inglewood, according to Cliff Baker, president.

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Athens	El Rey Oil Co., Westmore	1	2, 3-14		Rigging up
	Melrose Pet. Co.	1	12. 3-14		Rig
Castaic	Lang, Ed. W., Rupy	1	7, 5-16	455	May set casing
	Pedro Pet. Co., Jenkins	1	24, 5-17		Rig
	Worland, C. C., Jenkins-Owens	1	18, 5-16	310	Drilling
Chatsworth	Fernando Oils, Ltd., Holmes	1	18, 2-16		Grade
Inglewood	Vanguard Oil Co., L.A.I.	1	29, 2-14		Rigging up
Mint Canyon	Redwood Oil Co., Mitchell	2	22, 4-15	525	Idle
Newhall	Canyon Oil Co., Sanborn	1	6, 3-16		Rig
	Consolidated Pet. Co., Needham	4	13, 3-16	4300	Idle
	Mangrum and Page, Lintz	1	4, 3-15	852	Idle
	Tamas Oil Co., Perkins	1	11, 3-16	3920	Drilling
Palos Verdes	Rolling Hills Pet.	1	27, 4-14	6580	Prep to recement
San Fernando	Continental Oil Co., Howell	1	2, 2-16		Rigging up
Sunland	Casa Grande Oil Co.,Lopez-Lundy	1	1, 2-15	2320	Swabbing
Torrance	Dominguez Estate Co., Fee	1	2, 4-14		Rigging up
West Whittier	West Whittier Oil Co., Pellissier	1	17, 2-11	3400	Drilling
	Orange County				
Costa Mesa	Thompson, Milton N., Banning	1	9, 6-10	3500	Drilling
Olive	Jenkins, H. H.	1	17, 4-9		Location
Santa Ana	Gen. Pet. Corp., Was	1	21, 5-10	5955	Abandoned
Yorba Linda	Morgan, George, Fricke	1	21, 3-9	2195	Drilling
	San Diego County				
Imperial Valley	Sheran, John F.	1	3, 12s-8e	2850	Drilling

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Contra Costa	Tassajara Oil Corp.	1	9, 2s-1e	7200	Drilling
Humboldt	The Texas Co., Holmes-Eureka	1	22, 3n-1w	3784	Drilling
Monterey	Loma Grande Oil Co., Corey	1	23, 24s-10e		Location
	Priest Valley Pet. Co., Greve	1	22, 20s-12e	1995	Drilling
Sacramento	Amerada Pet. Corp., Carpenter	1	20, 4n-3e		Grade
	Superior Oil Co., Larsen	1	17, 3n-3e		Location
San Benito	Consolidated Pet Co.	1	11, 17s-11e	2120	Idle
Solano	Richfield Oil Corp., Potrero Hills	2	5, 4n-1w	790	Drilling
Sutter	Buttes Oilfields, Inc., McPherrin	6	1, 15n-1e	7075	Plugging

Rolling Hills Petroleum Co. has not tested the showings reported from 6450 ft. to bottom at 6580 ft. in Weston No. 1, located south of Highway 101 and west of Lomita. The company plans to recement the liner splice at 5000 ft. before proceeding with the production test.

With Lopez-Lundy No. 1 deepened to 2320 ft. and a liner cemented through perforations at 2222 ft., Casa Grande Oil Co. is swabbing muddy water. Although some so-called oil sand was cored, it apparently lacked adequate saturation. Location of the well is a couple of miles northeast of San Fernando in Lopez Canyon. A company spokesman recently revealed tentative plans for drilling another well in the same area.

Banning No. 1, Milton N. Thompson's Costa Mesa well, is drilling at 3500 ft. in hard brown shale. No showings of importance have been reported.

Only active project in the Yorba Linda field is George Morgan's Fricke No. 1 which is standing cemented with 5½ in. casing at 2000 ft.

Three out of five owners in the United States have never owned a new car. The used car lot is their marketplace.

Kelly Completes Rosecrans Well

Thomas Kelly & Sons, Inc., completed its first well in the Rosecrans extension area with initial production gauged at 175 bbls. of 32 gravity clean oil. With an 18/64 in bean, tubing pressure varied up to 300 lbs. as the flow had a slight tendency to head. Hole was bottomed at 7693 ft. and with formations open below the shoe of the water string at 7483 ft., the well was brought in after 36 hours of swabbing.

Across Compton Blvd. to the north of Kelly's well and 400 ft. west of its big Slabaugh No. 1, Southern California Petroleum Corp. is preparing to complete Rowena No. 1 after cementing 7 in. casing at 7300 ft.

Barnsdall Oil Co. and Wilshire Oil Co. reperforated 7 in. casing in Santa Fe Corp. No. 1 from bottom at 8790 ft. to 8400 ft. without obtaining a satisfactory flow, but with holes shot in the interval 8340-8390 ft., the well appears to be finding its stride, the last production being 100 bbls. a day of fairly clean oil. As the best looking cores were taken above this point, the flow probably will be killed before long to resume plugging and testing operations.

Apex Petroleum Corp. Hatfield No. 1 is coring for the oil sand at 7500 ft. while its easterly neighbor, Royalty Service Corp. Riverside Cement No. 1, is approaching the 7000 ft. mark.

Shore Line Drilling Co. has foundations for a rig at the southwest corner of Compton and San Pedro Blvds. immediately south of locations of Paragon Oil Co. and Midfield Oil Co.

St. Anthony Oil Co. resumed drilling in Gordon No. 1 and is now headed definitely for the O'Dea zone.

W. Montebello Well Flows 600 Bbl. Rate

Flowing at the rate of 600 bbls. a day, The Texas Co. brought in Wilcox No. 3 in the extreme westerly section of the Montebello field. Open in the Eighth zone is 165 ft. of oil sand streaked with shale which continued to bottom at 7700 ft. Accompanying the flow of 36.5 gravity clean oil is 1,000,000 cu. ft. of gas.

The Texas Co.'s Wilcox No. 2, located west of No. 3 and the most westerly driller, plugged bottom after finding the Eighth zone barren at 7650 ft. and is redrilling at 5000 ft., whipstocking to the southeast.

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After initialing 275 bbls. a day, Geo. F. Getty & Pacific Western Oil Co.'s Porter-Simmons No. 1, located on the southwest flank of the structure, is now flowing 220 bbls. cutting 0.2% through a 16/64 in. bean. The combined companies are planning to drill Pfister No. 1 approximately 330 ft. west of the recent completion.

In the area north of Beverly Blvd. and east of Wilcox Ave., R. R. Bush Oil Co. brought in Newhouse No. 1 flowing 600 bbls. and 2,000,000 cu. ft. of gas from the intervals 7475-7545 ft. and 7630-7715 ft. A packer is set in the blank casing between the perforations and the gas from the upper level is regulated by means of an adjustable orifice in the tubing at 7550 ft. Bush's Zanetti No. 2 in the same area appears to have overcome water trouble and is completing at 7670 ft.

Activity is steadily dropping, there being only 17 drilling rigs at the present against three times that number a few months ago. The hole card of the field has not yet been played, however; that is, no well has yet prospected for the Ninth zone which many believe will be productive. It has long been known that the first reasonably located project which failed to find satisfactory production in the Eighth zone would be made a deep test, but that situation has not arisen, all wells to date having found the 7300-7500 ft. interval too rich to pass up. Much speculation was occasioned by the filing of notices to drill two below present horizons, the first of which is still above 5000 ft.

Dominguez Awaits Outpost Results

Future development of Dominguez depends to a large extent on results of outpost wells now active at opposite ends of the field. Deepening one of the old Marland Oil Co.'s shallow zone wells in the southeast sector, Morton & Elder are below 6800 ft. in quest of the 7th and 8th Callender zones, the exploitation of which has extended production almost a mile west of former limits.

Jumping a quarter of a mile west of Russ Havenstrite's most westerly producer, Gus Pongratz Oil Co. is preparing to spud Grant No. 1, which if completed, will precipitate a new drilling boom.

Between the two extremes, Shell and Union Oil Cos. are continuing their routine drilling and repair programs. After some hard luck, Shell is completing Reyes No. 100 while Union is about ready to finish Carson No. 13.

H. R. O. Oil Co. Spuds Huntington Beach Well

H. R. O. Oil Co., headed by Dr. Fay L. Huff, Los Angeles dentist, is spudding in its interestingly located well in the easterly section of the old Huntington Beach field. Situated nearly a quarter of a mile from nearest production, the well will prove up much acreage for the company if successful.

North of the H. R. O. project, South Basin Oil Co.'s vital deep test is making hole near the 6000 ft. level. No new oil sands have yet been reported.

In the Five Points section, Mrs. Sara Orr had a little difficulty in getting Monterey No. 1 on production due to faulty tubing but she predicts a fair well when this is corrected.

M. K. F. Oil Co. is redrilling its H.B. No. 1 after setting a whipstock at 2560 ft., according to Art Graser of the firm of Graser & Wells, engineers on the job.

Pacific American Oil Co. is drilling its well No. 6 in the northwest area where the famous Ashton zones were first produced nearly 20 years ago by Western Union Oil Co. (now Shell Oil Co.)

Deep Aliso Test Is So Far Barren

Tide Water Associated Oil Co. has not found anything interesting below the discovery zone in Porter No. 12, current deep test of the Aliso Canyon field. But little information is available on formations encountered aside from the fact that no new oil sands have been uncovered. Present depth is slightly below 7500 ft.

With bottom at 5133 ft. and 8⅝ in. casing cemented at 4680 ft., Tide Water's Porter No. 3 is scheduled to become the new field's next producer.

Interstate Investment Well Nears Record

Very nearly an all time record for Wilmington wells was set by Interstate Investment Co. in completing its Long Beach Harbor No. 3 in only 11 days elapsed time, according to Emmet Jones, company president. With Superintendent Del Murtland in charge, the hole was carried to 3210 ft. 8⅝ in. casing cemented at 2880 ft., a pre-gravel-packed perforated liner landed on bottom, the tubing run to 3150 ft., the Christmas tree and flow lines hooked up and the well swabbed in for 150 bbls. a day.

Long Beach Well Pumps 175 Bbl. Rate

Recompleted in the 3600 ft. zone with 75 ft. open, Coast Supply Co.'s Leiburt No. 1 joined the lengthening list of good shallow producers at Long Beach by pumping 175 bbls. a day net with a 20% cut. Next to go on the beam is San Andreas Co.'s Higgins No. 6 which is being completed after redrilling to 3510 ft. D. D. Dunlap's No. 14, a new hole, is below 3000 ft., while Alamo Oil Co. is preparing to redrill an old well at Pine Ave. and Wardlow Road.

The Caminol Co. is perforating and testing Dominguez No. 3-19 after drilling to 8402 ft., plugging to 7675 ft. and cementing blank casing. This is the

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most northwesterly well ever drilled in the Long Beach field.

Allied Petroleum Corp. is making good time in its No. 34 which is headed for the 10,000 ft. zone. The project is located on Gundry Ave. north of Burnett St.

Dormax Oil Co. has completed installation of a large compressor on its 10,411 ft. No. 1 well and is planning to drill another to a shallower depth on the same lease.

First Well Drills On Flood Control

Culminating 17 months of political juggling, Continental Corp. last week spudded in its first well on the county flood control channel which forms the easterly boundary of the Wilmington field. The company plans approximately 20 wells for the 100 acre property which is expected to yield many millions of barrels of oil.

Wilmington maintained its position as most active California field by completing nine wells during the past fortnight, the largest being Union Pacific's No. E-21 which initialed 1325 bbls. daily.

Most important of recent wells is Royalty Service Corp.'s Nelson No. B-7 at the northeast corner of "E" St. and Pioneer. Located approximately on a line between General Petroleum Corp. Terminal No. 1 which topped Schist at 6787 ft. and Tide Water Associated Oil Co.'s Banning No. 1 which found basement at 6755 ft., the Nelson well proved a dip in the old surface by encountering it at 6886 ft. As in the previous deep tests, there was no oil in the schist.

A. P. I. Chapters Elect 1940 Officers

Chairman of the L. A. Basin Chapter of the American Petroleum Institute for 1940 is C. J. Dean, General Petroleum Corp. E. W. Larson, The Texas Co., is vice-chairman, and R. W. Cypher, Neilsen Pump Co., is secretary. The chapter holds meetings every other month in the Shell Recreation Hall, Hill and Obispo Sts., Long Beach, and opened the year with a meeting on Jan. 16. The program included a summary of the A.P.I. Chicago meeting, a talk on prepacked liners by J. B. Nelson, and motion pictures of the China Clipper.

1940 officers of the Coalinga-Kettleman Chapter of the A.P.I. are T. R. Tinker, Union Oil Co. of California, chairman; E. P. Campbell, Standard Oil Co. of California, and G. D. Carbiener, Kettleman North Dome Association, vice-chairman. L. W. Ralston was reappointed secretary.

Additional Valley

Goodrum & Vincent Testing Edison Area

Operating on a small block of land 2½ miles northeast of the Edison Field, Goodrum & Vincent, Inc. are drilling S.P. No. 3 near the west quarter corner of sec. 31,29-30. Recently started, the well was at 180 ft. in blue clay when last reported.

Elkhorn-Carriza Test Abandoned

Drilled to 5285 ft. with the sole use of cable tools, S. M. Newton's Stafford No. 1 is in process of abandonment. Spudded in February, 1939, in the southeast quarter of sec. 18,31-21, the well has worked almost continuously but without encouragement.

February Deadline on City Permit Renewal

Operators of oil wells in the city of Los Angeles are warned that a 100 per cent penalty will be levied on all applications for renewals of permits presented to the Board of Fire Commissioners after Feb. 1, 1940.

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Coastal District

North Flank Holds Ventura Ave. Interest

The north flank still holds the major portion of Ventura Ave. interest with British American Oil Producing Co. in the center of the spotlight for the moment. With its latest completion, No. 9, flowing nearly 500 bbls. a day through a 51/64 in. bean, the company re-entered No. 7 and gun-perforated the water string from 7660 to 7830 ft. and re-perforated the liner from the shoe of the 8⅝ in. casing to 85 ft. off bottom at 8400 ft. Tubing was run to 8350 ft. and the well swabbed back on production at the rate of 693 bbls. in 19 hours.

Most important of the dozen wells now drilling is California-Alliance Petroleum Corp.'s Hartman Ranch No. 2, which is also the most northerly, and if successful, will be the most northerly to find production. Heading for the "Hisey" zone discovered in the company's first well, 500 ft. to the southeast, the project will soon be coring for the oil sand at approximately 7300 ft.

Lloyd Corp.'s No. 3, which was completed the last of the year at plugged depth of 10,060 ft., is now beaned back from 1500 bbls. to 250 bbls. a day. Well No. 4 is sidetracking a fish near bottom at 10,130 ft. while cellar is being dug for No. 5.

Shell Oil Co. is planning to complete No. 35, the most northerly well on the long and narrow Edison lease, after cementing 7⅝ in. casing at 7970 ft. Shell's latest completions are Nos. 105 and 109 on the Taylor lease with yields of 1875 bbls. and 375 bbls. respectively.

Tide Water Associated Oil Co. obtained a 500 bbl. flow from Hartman No. 20 which was deepened to the Hisey zone after standing idle a long time at 5400 ft. Now bottomed at 7448 ft., the well shows a tendency to sand up.

Union Oil Prospects South of Guadalupe

One of the most important wildcat wells staked in coastal regions in many months is Union Oil Co.'s Pezzoni No. 1 which will be drilled in lot 126 of Rancho Guadalupe, five miles south of Guadalupe and four miles west of Betteravia. The project is said to seek a fault accumulation in the Monterey.

No wells have been drilled in the immediate vicinity, the nearest being Sovereign Oil Co.'s Donovan No. 1 which went to 5460 ft. two miles to the northwest and E. H. Moore's Union Sugar No. A-1, which drilled to 8135 ft. south of Betteravia.

One Flows; Three Drill In Santa Maria Valley

Continuing the rate of activity set in the last few months of 1939, three wells are now drilling in the Santa Maria Valley field.

Fred E. Cole, who has been the most active independent operator, is nearing final bottom in Paderewski No. 3, which at last reports, was below 5480 ft. after topping the Monterey at 5000 ft.

With O'Donnell No. 2-5 finished at 5640 ft. for 1325 bbls. a day of 14.5 gravity oil, Union Oil Co. is concentrating on the completion of No. 2-4 on the same lease and Russell-Lollier No. 1. The O'Donnell well is nearing the 5000 ft. level while the latter well is below 3500 ft.

Some relief for the glutted Santa Maria crude oil market is seen in the plans of H. Paul Grimm, who recently retired from the presidency of Bolsa Chica Oil Co. to head Mid-Coast Oil Co. which will erect a 3000 bbl. capacity refinery within the field.

Latest entrant to Santa Maria Valley is The Petrol Corp. which filed a notice of intention to drill a well on the Lakeview School property in sec. 27,10-34.

United Western Redrills Bradley Wildcat Well

United Western Oil Co. is reported to be sidetracking an old liner in Bradley No. 1, a wildcat well located in sec. 15,7-30 near Los Olivos in Santa Barbara county. Spudded in August of 1937, the hole was drilled to approximately 3935 ft. where a series of tests apparently failed to indicate the presence of oil in the Franciscan schist, which according to reports was topped about 2750 ft. M. Murdock of the company would neither confirm nor deny a rumor that the equipment would soon be moved to Rosecrans to drill a well under the name of Midfield Oil Co.

Texas Completes Shiells Producer

With bottom at 2993 ft. and 6⅝ in. casing cemented at 2900 ft., The Texas Co. brought in its No. 138 in the Shiells Canyon field in Ventura county. Initial gauges were at the rate of ten barrels per hour while settled yield through a ¾ in. bean was 175 bbls.

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
Santa Barbara County					
Carpinteria	Sunset Oil Co.	1	32, 4-25	3413	Idle
Cuyama	Hearte, O. K.	1	11, 9-25	2902	Abandoned
Goleta	Hamilton, W. C., Hollister	1	3, 4-29	760	Drilling
Lompoc	Sun-Bell Drilling Co.	1	28, 8-34	2982	Idle
Los Olivos	United Western Oil Co.	1	15, 7-30	3935	Drilling
Summerland	Oil Group, Inc., Hyland	1	16, 4-26	1315	Rigging up
San Luis Obispo County					
Elk Horn	Calif. Pet. Prod., Irons	1	19, 10-24	2527	Swabbing
	Newton, S. M., Stafford	1	18, 31-21	5285	Abandoned
	Newton, S. M., Well	1	3, 32-21		Grade
	Burrhus, V. E.	1	8, 32-22	60	Idle
	Burrhus, V. E.	3	27, 32-22		Grade
	Burrhus, V. E., Haberkern	1	21, 32-22	1833	Drilling
Midway	Lee, H. E., Stewart	1	7, 32-22	2210	Idle
Huasna	Gilmore Oil Co., Huasna Comm.	1	11, 32-14		Grade
Paso Robles	Epco, Inc.	1	27, 26-13	6157	Idle
Ventura County					
Conejo	Sulphur Springs Oil Co., Janss	1	33, 2-19		Rigging up
Moorpark	Shafer, Frank, et. al.	1	30, 3-19	736	Idle
Ojai	Argo & Rynning, M & A	1	7, 4-21		Location
	Coronet Oil Co., Coronet	4	17, 4-21	1165	Testing
Santa Susana	K. C. Oil Co., Marr	1	32, 3-17	1014	Idle
Sespe	Brain, Phillip, Cosby	1	14, 4-19	1120	Idle
	Nevada-Fortuna Oil Co.	1	13, 4-19		Rig
	G. E. Development Co.	7	13, 4-19	125	Drilling
	Hall, Henry Lynn, Tar Creek	1	35, 5-19	1275	Idle
	Renard Oil Co.	1	6, 4-19	1100	Idle
Shiells Canyon	Galveston Oil Co.	1	5, 3-19	3140	Idle
Simi	Ohio Oil Co., Vail	1	10, 2-19		Grading
South Mountain	Albatross Oil Co., Schiefferle	1	17, 3-20		Rig
	Rilling, Harry	1	13, 3-21	3127	Rig pump

daily of 29 gravity clean oil and 300,000 cu. ft. of gas.

Douglas-Stratton Oil Co. is reported to be planning development in the Shiells Canyon area but has not yet started work.

Savage Oil Co. is making some very interesting tests in Calumet No. 8, an old well which is being deepened below 3800 ft. Several formation tests have been run, but none has yet indicated commercial production.

Cole Committee in California

The Cole Oil Subcommittee of the House of Representatives concluded a three-day hearing in Los Angeles on January 18. Enlarged to seven members by the addition of Reps. Crosser of Ohio and Wolfenden of Pennsylvania, and accompanied by Rep. Lea of California and E. B. Swanson, of the Department of the Interior, the committee made an exhaustive study of the California oil situation. Questions asked on the proposal for a federal control bill dealt with a broad range of subjects, from conservation of natural resources to the advisability of offshore shipments in view of needs for national military defense. The witnesses, all of whom appeared voluntarily, included Governor Olson, State Oil Umpire J. R. Pemberton, and representatives of various California trade associations and other organizations. All of the witnesses opposed federal control of the oil industry in California, maintaining that the voluntary curtailment measures now in effect are adequate for the prevention of waste. Three California Congressmen, Izac, Sheppard, and Elliott, wired their opposition to Chairman Cole, and Rep. Coffee of Washington, in a letter to Mr. Cole, declared that the federal control bill would "lead to monopoly rather than true conservation." After concluding the Los Angeles hearing on Thursday, the Cole Committee planned to make an inspection of a number of California oil fields on Friday and Saturday.

Resolution of the California Oil and Gas Association on Oil Control Bill

The following resolution, opposing the Cole Federal Oil Control Bill, H.R. 7372, was passed by the California Oil and Gas Association and filed with the Cole Committee at its Los Angeles hearing.

Whereas there has been introduced in the Congress H.R. 7372 which purports to be designed to aid in the conservation of the petroleum reserves of the nation since such reserves are essential to national defense, and

Whereas an examination of said H.R. 7372 reveals that its provisions would not further the conservation of the nation's oil reserves but would merely centralize control of the oil industry of the U. S. in a Federal bureau, and

Whereas the California Oil and Gas Association is aware of the oil industry's responsibility to the nation from the point of view of the national defense, and

Whereas the oil industry spurred, not by government but by competition and its own inherent drive toward better utilization of crude oil, has developed; and is constantly developing, new methods of discovery, production, refining, and handling of oil, all of which improved methods have reduced avoidable loss to a minimum, and

Whereas the State governments, the Interstate Compact Commission, the so-called "Connally Hot Oil Law," and, in California a voluntary cooperative organization, all effectively prevent "waste" of oil, and

Whereas the California Oil and Gas Association believes that the national defense will be best served if the oil

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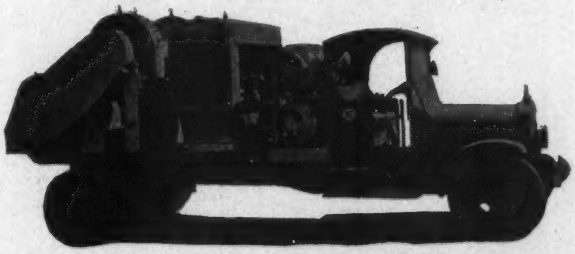

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industry is left to discover and develop new methods of oil discovery, oil production, oil refining, and oil transportation, as has been done through all the history of the free oil industry since its inception, and

Whereas the California Oil and Gas Association is convinced that to place the oil industry under Federal bureaucratic control will inevitably tend to hamper the development of new techniques and methods of more efficient discovery and use of oil and hence will tend actually to waste of the nation's oil reserves,

Now, Therefore, Be It Resolved that the California Oil and Gas Association is opposed to the enactment of H.R. 7372 into law, and

Be It Further Resolved that the President of the California Oil and Gas Association be directed to make such dissemination of this resolution as in his judgment seems fitting.

Ideco Chairman Dies in Ohio Jan. 11

Lewis J. Brown, 49, president of International-Stacey Corp., died Jan. 11 in a Columbus, Ohio hospital after an illness of ten weeks. Death came after a heart ailment of three years became aggravated.

Lewis J. Brown

Mr. Brown also was chairman of the board of directors of The International Derrick and Equipment of Texas, and of California. He also was chairman of the board of directors of the Roots-Connersville Blower Corp. of Connersville, Indiana and chairman and treasurer of Stacey Bros. Gas Construction Co. of Cincinnati.

Born in Bristol, England, Mr. Brown came to this country in 1907. His rise in business was rapid and he became president of the Nichols and Sheppard Co. Later he became executive vice president of the Oliver Farm Equipment Co. In 1930 he became president of the Kellogg Co., Battle Creek, Mich. where he introduced the six-hour working day plan, which attracted international attention.

Mr. Brown lived at his country home "The Willows" near Columbus. He was a member and trustee of St. Paul's Episcopal Church, trustee of Columbus Academy of Fine Arts, member of Masonic Lodge, R.A.M., Scioto Country Club, Columbus Athletic Club, Columbus Club, Rotary Club, Peninsula Country Club, the National Association of Manufacturers and the the American Petroleum Institute.

He leaves his widow, two children and five sisters.

Coast Oil Executive Named to New York Post

Called to a New York post as national sales executive for his company, R. T. Herndon, vice-president of The Texas Co. of California was today receiving congratulations from a widespread circle of friends in the California oil industry.

Here from Chicago to succeed Mr. Herndon is D. E. Beaton, long connected with the oil firm in various executive capacities in the midwest, and the south. The promotions are effective immediately, and Mr. Herndon is making plans to leave for New York very shortly.

R. T. Herndon

Mr. Herndon has been in charge of Pacific Coast sales activities of his company ever since the establishment of Texaco in this area ten years ago. He has served the petroleum firm over a period of 24 years since 1915, interrupted only for overseas war service in 1917-18 with the 90th Division Artillery. Mr. Herndon has directed Texaco sales campaigns from headquarters in El Paso, Denver, Minneapolis, Boston, and New York City.

At 44 years of age, Mr. Herndon will be one of the youngest executives ever appointed to eastern sales headquarters of the oil company, whose operations embrace all the 48 United States and more than 100 foreign countries. Mr. Herndon is married, has two children, and has been a resident of Arcadia.

Jensen Brothers Appoints A. A. Dill

New export offices in charge of A. A. Dill have been established by Jensen Brothers Manufacturing Co. at 1850 Hudson Terminal Building, 50 Church Street,

A. A. Dill

New York City, U. S. A. The cable address is "Axelson." Mr. Dill will look after the sale of Jensen Pumping Units and Rod Line Jacks in foreign fields.

Hugh B. Evans Closes Colorful Oil Career

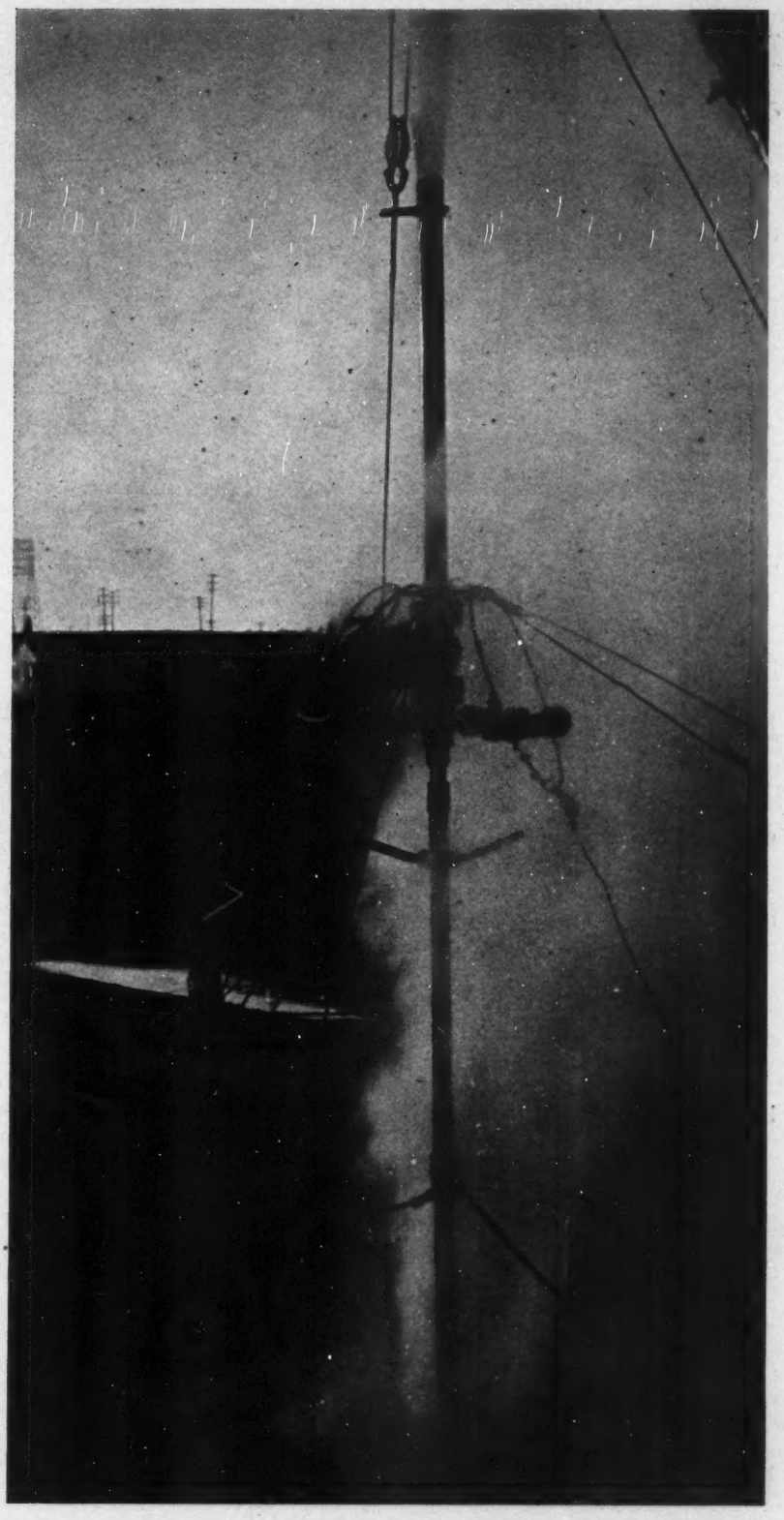
Last week marked the passing of Hugh B. Evans, one of the colorful figures of the California oil industry. Aged 75, Mr. Evans died of heart attack at his Los Angeles home on January 15, almost 11 years after the death of his son Hugh B. Evans, Jr. who up to that time was associated with his father in the operation of their properties in the Hovey Hills area south of Taft. These leases are now being operated by National Oil Company. Mr. Evans also pioneered some of the early wells of Signal Hill.

Of recent years his interests reverted to farming; for since his earlier years in Indiana Mr. Evans has farmed extensively in Canada and on the west coast of Mexico, and later acquired ranches near Hinkley and Victorville, and east of San Diego.

Closely associated in religious work with the late Lyman Stewart of Union Oil Company, Mr. Evans has been for more than twenty years one of the directors of the Bible Institute and Church of the Open Door of Los Angeles.

(Continued from Page 6)

"Every precaution was used to tie the rubbers in so that they would not blow out. The special



packer was rigged up and snubbed into the 6⅝-in. casing without a great amount of trouble as we allowed plenty of clearance for it to go inside of the 6⅝-in., the O.D. of this packer being 5½-in. The packer was set okay at 5:10 p.m. and the manifold tied down securely. At

Pressure Operated Valve and Spear Hookup

Specifications and Description of Material as Follows:

A: 1—Swivel Guide Plate 2" thick x 16" center, 7¼" bore with 1-2" hole.

B: 1—Stack 10' long made of 7" O.D. 28-lb. Grade "D" Casing.

C: 1—Swivel Tie-Down Plate 2" thick 26" diameter, 7¼" bore with 4—2" holes on 22" circle.

D: 1—7-1/16" bore Cameron 6000-lb. Test Double Flange Model Pressure Operated Master Gate Valve with 6" Series 900 A.P.I. Flanges.

E: 1—6" x 2" Special Mud Cross with 6" Series 900 A.P.I. Top Flange and 4½" O.D. 10-Thread Female Bottom Connection with 2—2" Series 1500 A.P.I. Flanged Outlets equipped with 2" Flanged Plug Valves and 1—2" Adjustable Flow Bean Assembly tested to 3000 lbs.

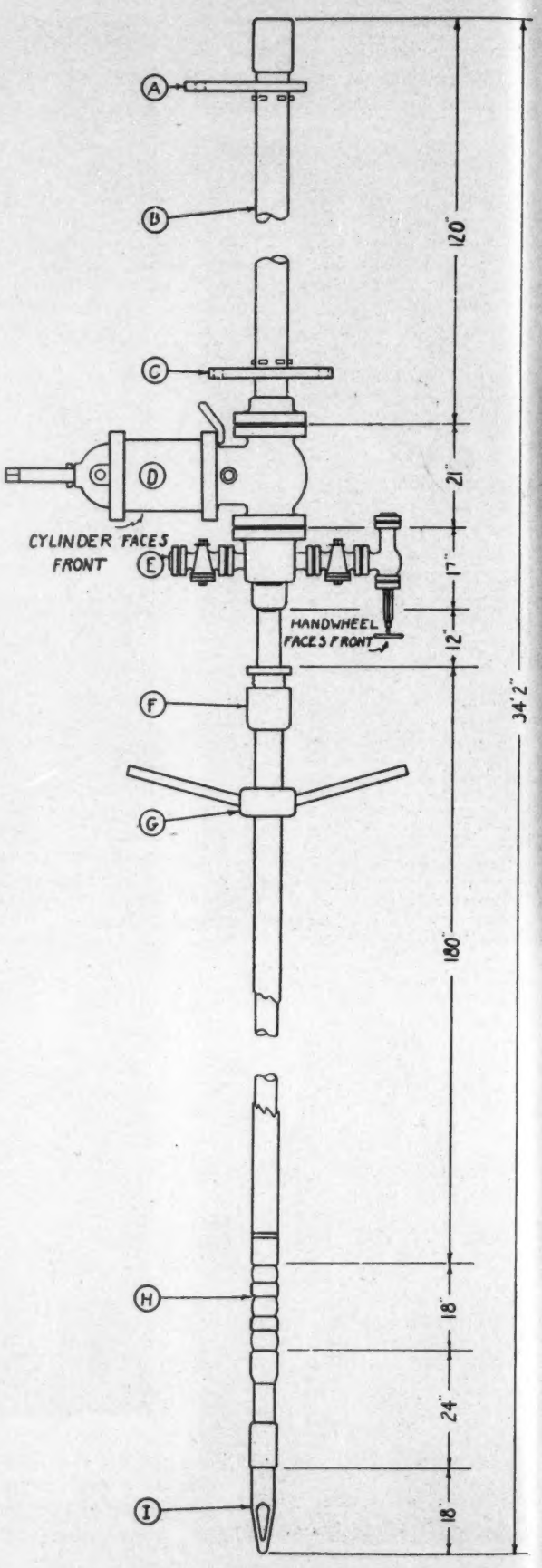
1—6⅝" O.D. 26 lb. x 4½" O.D. 16.60 lb: 10-Thread Special Packer, described as follows:

F: High-Pressure Stuffing Box and Gland Assembly to effect seal between Mandrel and Outer Sleeve.

G: 1—Turning Device with handle for rotation and setting of Packer. This constructed as follows: made of Forged Steel Ring, 12" diameter, 6" wide with bore to fit the 5-9/16" O.D. Outer Sleeve with 2—2" Solid Bar Handles, 2' long, welded securely to the Forged Ring and to the Outer Sleeve.

H: The main part of the Packer consists of a Mandrel 20' long over all made of 4½" O. D. 16.60 lb. Grade "D" Drill Pipe; and Outer Collapsing Sleeve made of 5-9/16" O.D. 22.20 lb. Grade "D" Drill Pipe, the Outer Sleeve and the Mandrel threaded to engage each other with 5 Thread Acme left-hand Washer being installed between the bottom of the Outer Jacket and top Packer Sleeve, the Packer proper consisting of 3—5½" O.D. Neoprene Rings securely wired to the Mandrel and held in place by Counter Board Thimbles.

I: 1—4½" O.D. x 18" over all 16.60 lb. Special Blunt Nose Guide equipped with 4 openings as indicated on drawing.



And that's that, says leather-helmeted Roy Bean

6:25 p.m. the 6-in. Cameron Pressure Operated Valve was closed using 1500-pound pump pressure and it worked like a charm. The well was shut in and all the noise gone. We then pumped 480 barrels of 80-pound mud into the well with the Perkins Cementing, Inc. equipment, periodically blowing off the entrapped gas. At 2:30 a.m. the following day the well was completely under control."

The scores of people who were permitted to come within a stone throw of the well will realize that Roy Bean's report falls far short of recounting with appropriate color and vigor what was a breath taking, tremendously hazardous battle of men and equipment against a raging monster such as often in the past has defied all efforts at control until wrecked by its own violence to leave only a huge crater to mark another oil field disaster.

Roy might have been excused, too, if he had dwelt exuberantly on the response of his company's powerful ram gate valve to the 1500 pounds pressure applied to close it against the wild well's 50 to 60 million-foot flow. The score of men who circled within a few feet of the deafening roar as they screwed home the packer expanding threads of the special spear scarcely had time to wonder if the gasser's scream would ever be stilled when the pressure was applied through the closing inlet of the big valve, and the gate which stopped the great gas flow moved deliberately and surely into its seat. Roy probably feels that you don't have to say much about equipment that has that performance on its record.

Lane-Wells Executives Visiting Mid-Co. Branches

Rodney S. Durkee, president, and M. E. Montrose, general sales manager of Lane-Wells Co., are visiting the Mid-Continent branches of the company between Jan. 21 and 31.

The activity of Lane-Wells Gun Perforator and Electrolog Services as developed in these fields during the past year indicates a need for more field units and field crews in this area, according to Mr. Durkee.

The Lane-Wells Los Angeles plant will be operating at capacity during the coming year to complete the field truck units required.

Purchasing Personnel-ities

By Leo S. Busby
Associate Editor
Southwestern Purchasing Agent

William Harold Pierce

A few years before the United States entered the World War, the Los Angeles High School included in its curriculum a course in military training. Students taking this training were called "cadets." Shortly after this course was introduced, there was developed a test for individual proficiency, and once a year under the direction of an officer from the California National Guard, certain cadets who had shown their proficiency were put in a test drill. One day these cadets were standing at attention on the school campus when the inspecting officer, in a sharp, crisp voice, called the name of one of the cadets. A slim, straight boy stepped from the front rank. The officer pinned a shining decoration on his coat, and vigorously shook his hand. He was the first private in the high schools of Los Angeles to win individual proficiency in the manual of arms.

In every man's life there are little, inconsequential incidents which are among his fondest and most cherished memories. As he speaks of his L. A. high school days, the sparkle in his eyes and the half-sheepish smile on his face tell you that, to William Harold Pierce—Hal, to you, and to his many friends—these are memories which the gathering years only serve to make the more precious.

In his position now as purchasing agent for Robert S. Lytle, operator of the Doheny oil interests, he has lost none of the youthful enthusiasm which he displayed on the high school parade ground. A friendly greeting, a pleasant smile, and an honest-to-goodness handshake welcome the visitor to his office on the eleventh floor of the Petroleum Building in Los Angeles. And, we understand, salesmen are no exception.

Hal is a native son of California and received his education in the Los Angeles public schools, supplemented in later years by study with the Southwestern University of Law, and the La Salle Extension University. After graduating from L. A. High School, he worked for the telephone company until April, 1917. Five days after the United States declared war, Hal enlisted in the Signal Corps of the U. S. Army as a private.

Like many of the boys who enlisted immediately for service in France, he hardly got to see the Atlantic Ocean. After a few months, he was transferred to the Officers Training School at Leon Springs, Texas, and was commissioned and sent to Camp Vail, New Jersey, as a First Lieutenant in the 425th Telegraph Battalion. From there he went to another training camp at Syracuse, New York, where he was made camp signal officer, and had charge of recruit instruction. In all, he spent nineteen months in the service of Uncle Sam.

Hal Pierce's first introduction to the oil industry came in 1919 in the form of a job with an oil well supply concern at Coalinga. After about four years of selling oil well materials, he got to looking over the fence and decided that maybe the grass was greener on the other side. Forthwith, he got himself a job buying oil well materials for the E. J. Miley Oil Company.

Sometime around 1927, the Doheny oil interests began to interest Hal and he transferred his affections to the Doheny Stone Drill Company which was just beginning operations. For several months Hal enjoyed a purchasing agent's Roman holiday, spending several millions of dollars for new equipment, machinery and supplies. Later, when the Doheny Stone Drill Company was sold, to become the present Hydril Company, Hal stayed on with the Dohenys, first with the Petroleum Securities Company, and now with Robert S. Lytle.

For recreation, there are two sports that rate tops with Hal Pierce, deep-sea fishing and golf, and of the two, we suspect it's golf preferred. Of course, you've heard of the Nineteeners, that well-known club composed of thirty-six members, all connected with the oil industry. The remarkable thing about the Nineteeners is that they have been together for six years, the same members, meeting regularly every month, with never a miss. Hal didn't say where they meet, but from the name of the club, we can get a fairly good idea. Also, that might explain the reason why they never miss. Incidentally, Hal is vice-president of the Nineteeners, and if you are laboring under the impression that a v.p. should be seen and not heard, just ask him about the Nineteeners Golf Club.

In the News

A couple of months ago, we told you about the transfer from San Francisco of Phil Lipschultz to a buyer's desk at the Los Angeles offices of the Shell Company. Phil has become thoroughly acclimated by now but, after observing how mopey some of our citizens go about their business on our downtown sidewalks, he ventures the opinion that fog is not necessarily a matter of geography. By the way, on January 26, Phil completed his twentieth year with Shell. He's beginning to get the idea that perhaps the job is permanent!

While we're at Shell, we might mention that Ken Bright—better known as "Brick"—has been transferred from the purchasing department in L. A. to the stores department at Watson. "Brick" was a star tackle at U. S. C. in 1933 and 1934. Replacing "Brick" in the purchasing department is Harold Boothe who comes from the refinery at Watson.

Incidentally, Harold Olympius who is now a buyer at Shell Company, started with the company about fifteen years ago as a pickup boy at the Shell Garage on L. A. street. An interesting note in this connection is that his boss at that time was Dan Hudelson, who is now employed in the purchasing department at General Petroleum. How these boys do get around-

We are sure that the many friends of Mary O'Brien Casey, secretary to Bill Beck, at General Petroleum, will be delighted to learn that Mary is rapidly recovering after an emergency appendectomy at the Queen of Angels Hospital. Now Mary will really have something to talk about!

Yowell Service Announces New Shoe Squeeze Cementer

Yowell Service Co., Santa Fe Springs, Calif., has announced development of a removable cementer, especially designed for shoe squeeze cement jobs. The tool, known as the Yowell Removable Cementer, Shoe Squeeze Type, has a number of important features never before provided in equipment of this type. One is that when the cement job is completed and the tool removed from the hole, no foreign material is left in the hole to be drilled up. Another feature is that the tool can be used for cementing through shot holes, etc., in wells where no "low zones" are present below the cementing point. This is a decided advantage in remedial work in old wells, since the need for rigging up to drill out foreign material is entirely eliminated.

The Cementer consists principally of an outer mandrel equipped with high pressure packer rubbers, fluid ports and a setting spear and an inner traveling rod having fluid ports which can be opened or closed simply by raising or lowering the run-in string. This inner rod controls direction of fluid circulation. "J" locks are provided for operating the spear and holding the tool in open position while running in the hole. There are three packer rubbers, one faced upwardly and two downwardly. The one faced upwardly provides a means for building up a fluid level above the tool in wells with low fluid levels. The two faced downwardly afford a double seal against cement leakage up the hole. The entire assembly is shop tested to 5000 lbs. per square inch cold water pressure.

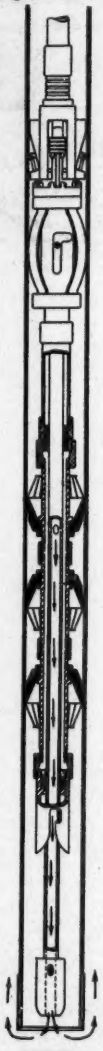
An outstanding operating feature of the tool is that no back-pressure device, other than the cementer itself, need be used, as it has been found that very little cement, if any, squeezed under high pressure comes back inside the casing on either shoe squeeze or shot hole cement jobs. There is no tendency for the tool to drag or stick during normal cementing operations.

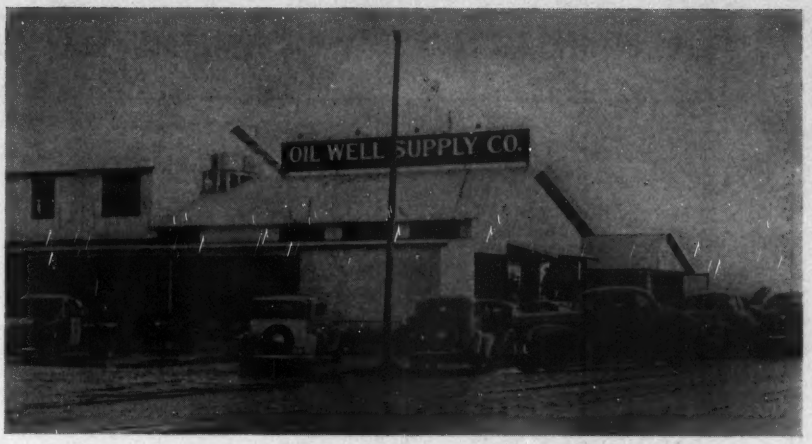
In operation, after the cementer has been run in the hole and anchored in the casing, the inner rod is lowered, shutting

off the fluid by-pass port and allowing cement slurry to be pumped through the tool, out below the shoe and back of the casing, until the desired pressure is reached. The Cementer is held in place at all times by the weight of the run-in string, friction of the packer rubbers, and the fluid column between the upper packer rubber and surface rams which are closed around the run-in string on high pressure jobs. In the event the operator is unable to establish "breakdown" pressure before starting cementing operations, the tool can be completely removed for further hole conditioning, leaving no foreign material to be drilled up.

All excess cement can be pumped out of the well quickly and easily on completion of the cement job, leaving nothing to be drilled out except the predetermined amount of cement the operator desired to leave in the shoe joint.

Full particulars can be obtained by writing direct to Yowell Service Co., Santa Fe Springs, Calif.





Oil Well Supply Co. made a festive affair of the opening of their new store at Coles Levee.

South America Advances

(Continued from Page 15)

pany, Astra and La Republica, another Standard company.

The wells in the Salta fields average less than 1500 feet in one field and nearly 5000 in another. The deepest are in Aqua Blanca which extends over the border and is produced on the other side by Bolivian operations. Y.P.F. and Standard Oil Company are the only operators in this area.

The only production at the present time in Jujuy Province is the Yuto field which is a very small operation of Y.P.F.

Both the deepest and shallowest well—depth averages are found in the Mendoza area. In the most southerly field, Sosneado, the average depth is about 500 to 600 feet. In the Tupungato, just south of the city, Mendoza, depths reach nearly to 6000 feet. The Sosneado is operated by Compania Rio Atuel; the other fields belong to Y.P.F.

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MAPS

Large maps of Los Angeles Basin oil fields and map showing all California oil fields. Price $15.00 each on paper and $20 each on cloth. Individual state oil and gas maps of Mid-Continent and Rocky Mountain regions. Maps show geological cross sections at base. These maps indicate wells drilling, wells producing and abandoned, with depths.
All maps revised up to date of purchase.
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Department of the Interior, United States Land Office, Sacramento, California. Notice is hereby given that leases of the oil and gas deposits in the following described lands are offered to the responsible qualified bidder of the highest bonus per acre, pursuant to the provisions of section 17 of the leasing act of February 25, 1920 (41 Stat. 437), as amended, at the royalty rate scale in the lease form shown in circular 1386, at a sale to be held in the office of the Registrar of the district land office at Sacramento, California at 10:00 o'clock A.M. on February 1, 1940: Coalinga East Side oil and gas field, Unit No. 1, NW¼SE¼, except W½ SW¼ NW¼ SE¼, Section 2, T. 19 S., R. 15 E., M.D.M., 35 acres, and Unit No. 2, E½ SE¼, N½, NW¼ SE¼ Sec. 20, T. 19 S., R. 15 E., M.D.M., 100 acres; Coalinga West Side oil and gas field, E½ SE¼ Sec. 2, T. 21 S., 14 E., M.D.M., 80 acres. The successful bidder must deposit on the day of the sale a certified check on a solvent bank, or cash, for one-fifth of the amount of each bid, and file a showing of qualifications to receive the lease required by section 7 of General Land Office circular 1386. The remaining four-fifths, together with the annual rental in advance at the rate of $1.00 per acre, must be paid and a $5000 corporate surety bond must be furnished prior to the issuance of the leases. The bidders are warned against violation of the provisions of section 59 of the United States Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids at the discretion of the Secretary of the Interior. Register.
1/20b

EMPLOYMENT WANTED

Graduate geologist with degrees in mining and petroleum engineering. Sixteen years practical experience. Good surveyor and draftsman. Speaks four languages and will go anywhere. Box 14, care Calif. Oil World. 1/20bd

Oil Men's Calendar

C.N.G.A. Meeting First Thurs. Each Month.

February

12-15—American Institute of Mining & Metallurgical Engineers, New York.

April

8-12—American Chemical Society, Cincinnati, Ohio.
10-12—American Association of Petroleum Geologists, Chicago, Ill.
11-12—American Petroleum Institute, Eastern District, Division of Production, Columbus, Ohio.
18-19—National Petroleum Assn., 37th Semi-Annual Meeting, Cleveland Hotel, Cleveland, Ohio.

May

1-3—Petroleum Industry Electrical Assn., Dallas, Texas.
15-17—Natural Gasoline Association of America, Hotel Tulsa, Tulsa, Okla.
18-25—Int. Pet. Exposition, Tulsa.

Maximum airplane power is produced when the fuel is injected directly into the cylinders, aeronautical experiments show.

Cheering news is an attachment for pneumatic-tired lawn mowers which converts them into gasoline-powered snow plows.

California Crude Oil Production

Two Weeks Ended January 13, 1940

	January Daily Quota	Average Daily Production	Excess
San Joaquin Valley			
Beiridge—North	12,227	11,573	*654
Beiridge—South	2,064	1,550	*514
Buena Vista	16,614	16,374	*240
Canal	5,877	5,818	*59
Coalinga-E. (Eocene)	11,505	12,910	1,405
Coalinga—East-West	15,532	11,341	*4,191
Cole's Levee	3,345	3,143	*202
Edison	2,328	2,375	47
Elk Hills	7,509	9,068	1,559
Fruitvale	6,080	6,513	433
Greeley	3,608	3,407	*201
Kern Front	7,342	6,628	*714
Kern River	6,762	4,015	*2,747
Kettleman No. Dome	33,771	49,600	15,829
Lost Hills	3,979	3,740	*239
McKittrick	3,673	3,498	*175
Midway	37,118	31,370	*5,748
Mount Poso	10,091	9,757	*334
Mountain View	9,198	9,972	774
Rio Bravo	7,410	7,845	435
Round Mt. and Coffee Canyon	7,561	7,496	*65
Ten Section	8,490	8,287	*203
Wasco	1,175	1,235	60
Other Fields	3,361	3,204	*157
TOTAL	226,620	230,719	4,099
Coastal Counties			
Elwood	3,680	3,916	236
Rincon	2,508	4,108	1,600
Santa Maria	6,240	3,150	*3,090
Gato Ridge	2,441	16	*2,425
Santa Maria Valley	18,602	10,384	*8,218
Santa Paula-Newhall	5,708	6,081	373
Ventura Avenue	31,263	35,927	4,664
Other Fields	5,169	5,673	504
TOTAL	75,611	69,255	*6,356
Los Angeles Basin			
Alamitos-Seal Beach	7,140	6,828	*312
Brea-Olinda	8,040	5,673	*2,367
Coyote—East	3,253	2,827	*426
Coyote—West	10,013	7,010	*3,003
Domingues	16,765	19,333	2,565
El Segundo	2,742	2,720	*22
Huntington Beach—New and Old	23,159	29,349	5,190
Inglewood	12,954	12,948	*6
Long Beach	40,489	44,375	3,886
Montebello	5,884	6,195	311
Montebello-West End	24,912	20,881	*4,031
Playa del Rey	4,081	4,538	457
Richfield	7,271	8,460	1,189
Rosecrans-Athens	8,078	9,907	1,829
Santa Fe Springs	24,294	26,360	2,066
Torrance	5,414	5,165	*249
Torrance "34" and "D & B"	7,033	7,920	887
Wilmington	79,927	85,047	5,120
Other Fields	3,701	4,032	331
TOTAL	295,153	308,568	13,415
STATE TOTAL	597,384	608,542	11,163

*—Shortage.